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United States Cycle Tires are Good Tires

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Be sure it is United States.

Popular Science Monthly

Waldemar Kaempffert, *Editor*

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How Gold Can Make Us Poor

Giant dredges for placer-mining may make the dollar shrink

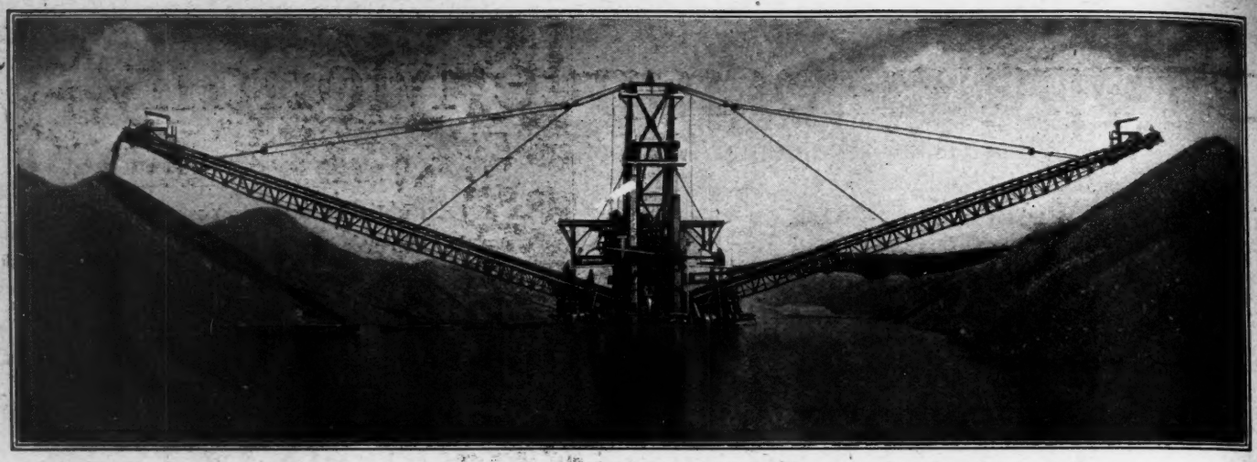
The man in the linen duster, standing on one of the dredging buckets, is Mr. N. Cleaveland, who built the giant dredge; and the other man is W. P. Hammon, dredging contractor

THE more gold there is in the country the poorer we all are. Does this sound startling and unreasonable? It may be startling, but let us see if it is unreasonable.

Gold is the standard, the yard-stick, by which the value of things in the United States—and in all countries that have adopted the gold standard—is measured. By it the monetary value, or purchasing power of the dollar, is measured.

It is easy to understand, then, that anything that lowers the intrinsic value of the standard—that shortens the yard-stick—diminishes the value and therefore the purchasing power of money; and it is also easy to see that, just as apples are less valuable when there is an over-supply in the market, so gold is less valuable at times when the quantity produced is greatly increased.

Now, gold is mined in many parts of the United States, and the quantity of it available for coinage and other purposes is growing steadily. A certain quantity of the precious metal is normally absorbed in the arts and industries without causing a marked disturbance of our monetary system, which expands in harmony with the country's steadily growing wealth. But supposing that a new and prolific source of the yellow metal is found, or that some method is invented which will make it possible to extract the gold from its ores or from placer deposits easier and at less expense: the supply of gold may suddenly increase so that it will exceed the normal demand. The immediate effect would be a depreciation of gold; and as all other monetary values are measured by the value of



This gigantic dredge can dig from 12,000 to 15,000 cubic yards of earth and gravel a day, and extract from it practically every bit of gold it carries

gold, their value would shrink in proportion. But it is clear that a dollar which is worth less than one hundred cents will buy less than a dollar of full value.

Why You Pay More

If today you pay from twenty-five to one hundred per cent more for your food, your clothing, and other commodities than you had to pay ten or more years ago, the over-production of gold is one of the principal causes. Of course during the war other causes contributed to the higher cost of living; but the upward tendency of the prices of practically all commodities was strongly marked long before the war.

In the years immediately preceding the war, improved methods of mining and the introduction of the cyanide process of extraction caused an increase in the production of the yellow metal, which led to its depreciation and the diminution of its purchasing power, hence to an increase in the cost of living.

In 1880 the production of gold in the United States represented a value of $36,000,000; in 1900 the output reached $79,171,000; and in 1918 $84,456,600.

The value of the metal absorbed for coinage purposes, which in 1850 was $31,981,739, reaching $62,308,279 in 1880 and $99,272,943 in 1900, dropped to $10,014,000 in 1918. This sudden drop was due to the contraction of our national coinage by reason of war conditions. The enormous surplus that thus remained in other than coined form emphasized the depreciation of the metal and helped to boost the cost of living.

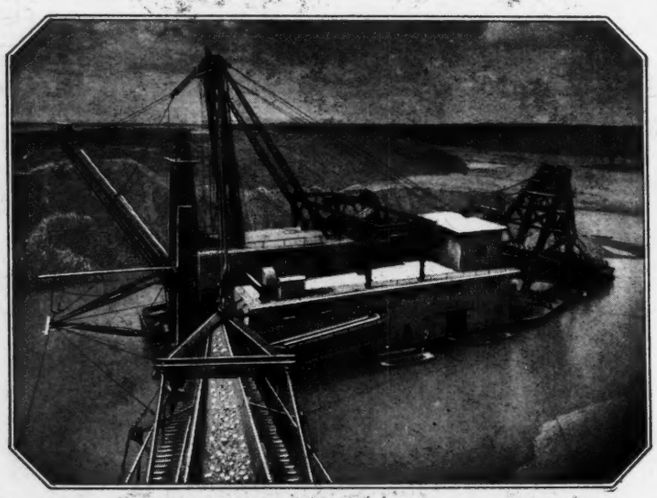
In the light of these considerations, it becomes evident that the invention of a powerful dredge, which can dig up from 12,000 to 15,000 tons of gold-bearing alluvial deposits a day and extract practically every ounce of the yellow metal the gravel contains, can scarcely be expected to lower the high cost of living. Such an invention makes it possible and profitable to work over gold-bearing deposits so poor in gold that they could not be worked with profit by any other method of mining. The dredge shown in the pictures was built by N. Cleaveland, and is in successful operation along the Yuba River, near Marysville, California.

The dredge, together with the machinery for driving it and the apparatus for extracting the gold from the soil, is carried by a barge 165 feet long, 68 feet wide, and 11½ feet deep. The entire equipment weighs more than 2,000 tons. One hundred manganese steel buckets, each holding sixteen cubic feet of earth or gravel, are attached to an endless chain which runs over rollers at the top and bottom of the digging ladder, which is raised and lowered by means of suspension tackle. The buckets have sharp cutting edges and can dig to a depth of 80 feet under water. The bucket chain is driven by electric motors. The dredge is kept at work day and night.

It Stops Once a Week

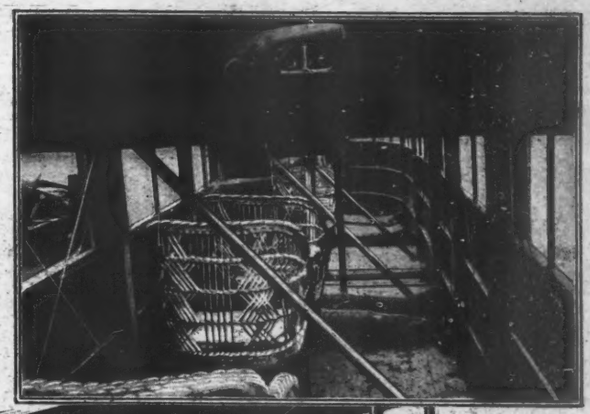
The earth and gravel dredged up by the buckets is dumped upon a revolving screen at the upper end of the digging ladder. The screen is made of perforated plates of high-carbon steel. It has a length of fifty feet and a diameter of nine feet. A powerful stream of water pumped by electricity washes the gravel and breaks up lumps. The gold is washed out by the water, and, together with other heavy matter in a fine state of division, passes through the screen and is washed into an adjustable distributor, which deposits the gold and other heavy materials on inclined tables indented by shallow grooves filled with mercury. As the gold is washed down it comes in contact with the mercury, forming an amalgam, which is removed from time to time to extract from it the gold. The gravel tailings are carried off by conveyor belts.

Once every week all dredging operations stop. The gold-mercury amalgam is collected, and fresh mercury is poured into the channels of the amalgamation tables. The amalgam is pressed into the form of bricks and sent to the distilling works. There the mercury is recovered to be used again, and the gold is molded into bricks and refined. The cost of operating one of these dredging equipments is about five cents a cubic yard.

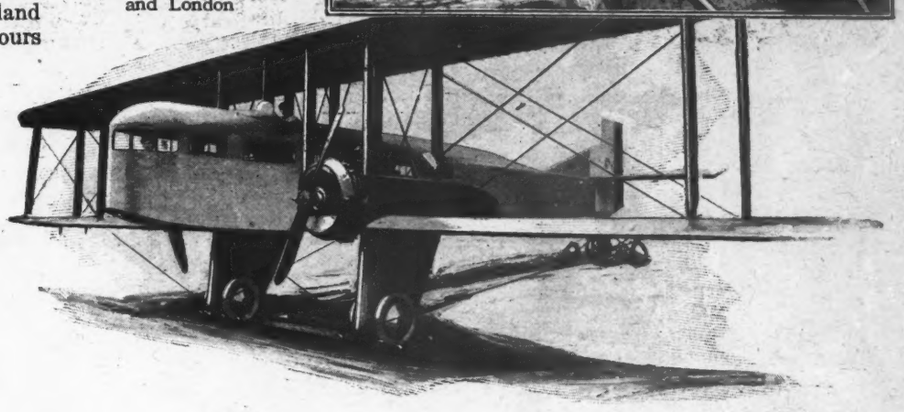


After the gold-bearing gravel and earth has been thoroughly sifted and washed and relieved of the precious burden of gold, the tailings are dumped in piles by conveyors

Across the English Channel by Air in Three Hours



The *Goliath*, the Farman passenger-carrying aero-car. Two 270-horsepower Caudron engines give it a speed of eighty miles an hour



Originally designed for bombing Berlin, the *Goliath* has been refitted for a regular passenger service between Paris and London

TRAVELING from London to Paris by airplane is no longer the exclusive right of airmen and celebrities. Anybody with eighty dollars in his pocket can now make the trip; for eighty dollars is the fare charged by the Farman brothers in their new Paris-London air line.

One machine, named the *Goliath*, is already in use, and five more of the same model are in course of construction. You start from the Buc Aerodrome near Paris, and you can land at Croydon, England, three hours later. If you want to take baggage with you, you may do so.

The *Goliath* was originally built for bombing Berlin, but the armistice cut short its career, and it has since been transformed for commercial use. It makes an admirable passenger-carrying aero-car. Its long fuselage cabin affords seating space for fourteen persons in springy leather arm-chairs with wicker backs. The chairs are placed singly, one behind the other, from end to end. Twenty passengers may be carried, but the number has been limited to fourteen for comfort.

Equipped with two 270-horsepower Caudron engines, the *Goliath* can maintain a speed of from seventy to eighty miles an hour, which is fast enough for commercial purposes. The employment of two engines practically eliminates the risk of accident; for if one engine goes "dead" the other is powerful enough to continue the flight. The machine has a wing breadth of nearly one hundred and fifty feet.

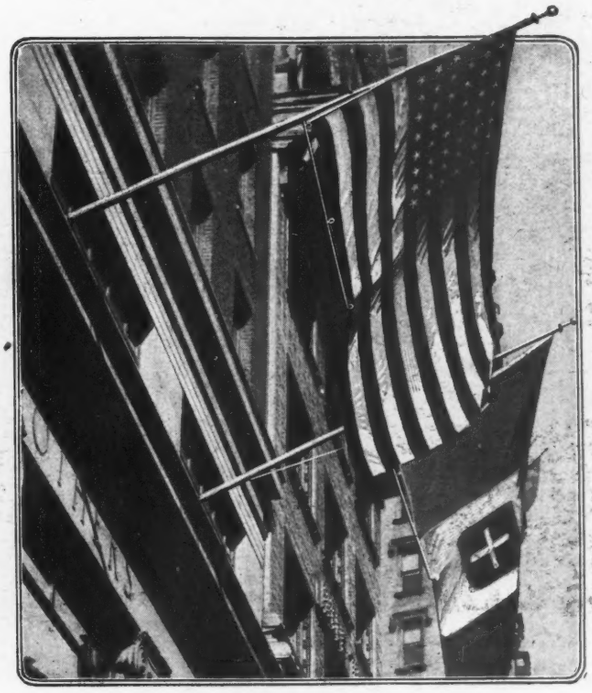
For the person of fastidious taste who desires quicker service in a car of luxurious appointment, the Farmans have a veritable limousine of the air, equipped with a salon cabin containing tables, arm-chairs, and a lavatory. Three or four passengers may be accommodated.

How to Keep the Flag of Freedom Free

A DEVICE has been invented making it certain that "the star-spangled banner in triumph shall wave" and not get all tangled up when displayed on a horizontal staff.

A wire rod extends along part of the edge of the flag, and is held in place by a clip at each end. The larger sizes may have a hook to pass through one of the eyelets in the flag. This, in addition to the clips, insures stability in heavy winds and storms.

The invention prevents the flag from being whipped, wrapped, or tangled, and is a protection against tearing or other injury. The lower clip can be of heavy construction so as to hold down that part of the flag. In attaching it, the hook is first passed through the eyelet and then the edge of the flag is forced into the clips. By increasing the number of turns in the lower clip it can be made as heavy as desired.



This non-tangling device for flags is a wire rod having coiled clips at each end

Using the Telephone to Test an Armature

IN order to discover a short circuit, open circuit, cross-connection, or ground, it is necessary to have a set of test leads and lamp, preferably on a 110-volt line. Tie a string around the commutator, and place both sides of the test leads under the string, against the segments, about one fourth of the circumference apart.

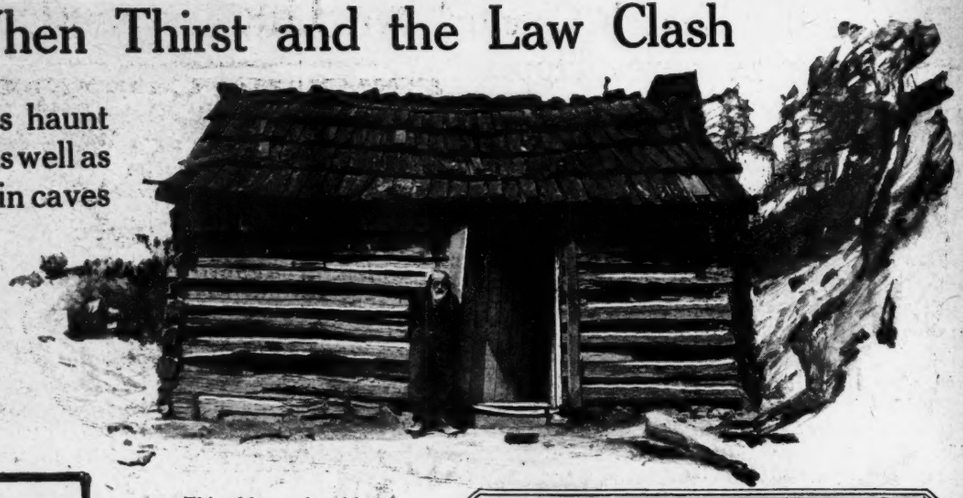
Next hold the receiver to the ear with one hand and receiver leads to commutator with the other, taking care to touch adjacent segments, and, traveling from one test lead to the other, move test leads farther around, repeating until the commutator has been circled.

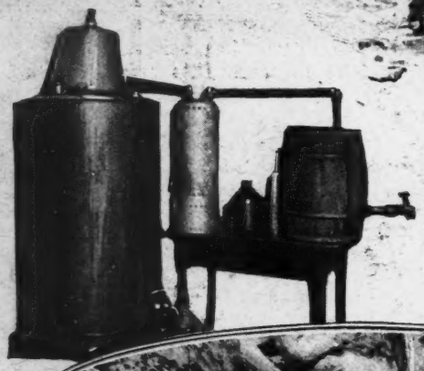
A low buzz in the receiver indicates a good flow of electricity. If you get no sound whatever there is a dead short circuit. An open circuit is indicated by a very loud buzz.

When Thirst and the Law Clash

Moonshine-makers haunt New York cellars as well as Kentucky mountain caves

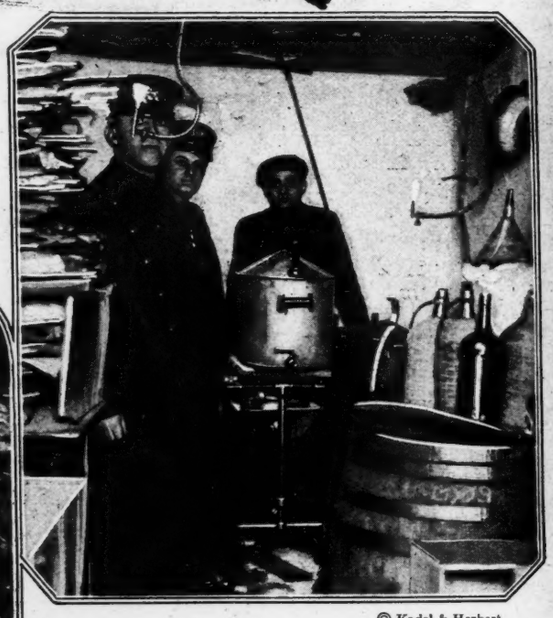
The home-made still shown below was found, not in a mountain cave, but in a New York city flat. Revenue men say that cities are their best hunting ground





This old man is said to be the most ancient of moonshiners. He was born 102 years ago in the Kentucky mountain cabin behind him. Perhaps he did not drink his own whisky

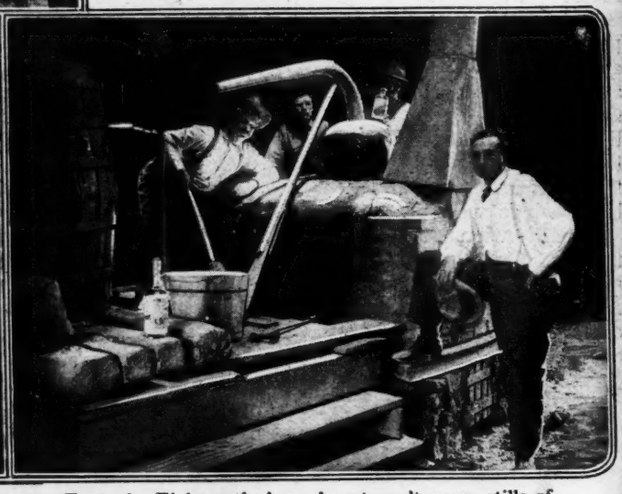
For movie purposes this is the only kind of a site for making moonshine whisky. The folks there don't care if the country does go dry



© Kadel & Herbert

With the family wash-boiler and a little ingenuity one can make a very useful still. This one was found in a New York city cellar

Flanked by the raiders whose business it is to help prohibition prohibit, we see the remains of a still. The snakelike coil is technically known as the "worm"; in it the vapors condense and start the red-eye flowing



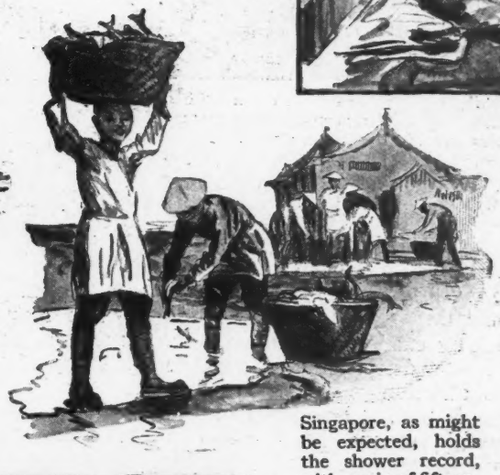
Even the Eighteenth Amendment can't move stills of this size to big cities, no matter how great the demand for cases in the desert. The raiders found this one in the Southern mountains, where the best stills live

It Rains Many Things Besides Water

Next time someone tells you of its raining fish or frogs, don't laugh: the story is probably true. There is, for instance, record of a fish rain in 1666 that showered smelts all over Stanstead parish in merry England

At Baton Rouge in 1896 it rained ducks, catbirds, and woodpeckers. We pause right here to say that scientists explain these showers by the lifting power of the wind and the ancient principle that what goes up must come down; and you never can be sure what's up

Getting down to 1917, John Lewis, of Aberdare, Wales, reports: "I was startled by something falling all over me. . . . On putting my hand down my neck, I was surprised to find they were little fish"



Singapore, as might be expected, holds the shower record, with a rain of fifteen-inch catfish, which the Chinese and Malays gathered up by the basketful

Boston, in the days of the "plug" hat, had what it called (being Boston) "a piscatorial deluge." But in Connecticut that same year it rained fish and ice together, which we call thoughtful

No less a person than Alexander von Humboldt writes of a downpour of fishes in the Andes which seemed to be aided and abetted by a very active volcano. The natives said they rather counted on fish showers to reduce the H. C. L., usually having several a season

Nine native eye-witnesses, urged by a canny Scot, made depositions before a magistrate attesting the truth of their tales of a shower in Bengal during which at least five kinds of fish fell from the heavens

Making the Dumb to Speak

The latest methods of specialists in treating victims of shell shock

By Lucien Fournier

COMPLETE loss of speech was one of the serious results that developed in many soldiers suffering from shell shock. It afflicted most frequently men whom the horrors of the Great War had brought to a state of nervous tension which predisposed them to this particular pathological condition. Drs. G. Liebaut and E. Coissard, two eminent French nerve specialists, studied the disease, and organized a clinic for restoring to these soldiers the power of speech in accordance with the methods employed in schools for the treatment of deaf-mutes.

Among the patients in that clinic there are none who have lost their ability to speak through any physical injury of the organs of speech. Nearly all of those who undergo treatment are eventually cured or at least greatly improved by a systematic training of the organs of speech, which include the lungs, the larynx, the pharynx, the mouth, nose, and lips.

Careful Examination of Each Patient

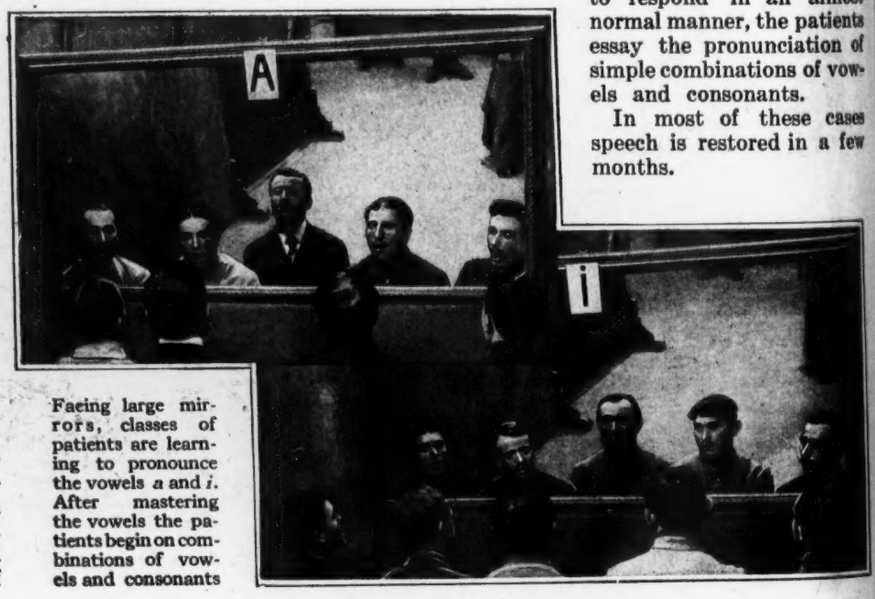
Before beginning treatment the doctors carefully examine each patient to ascertain his lung capacity, method of breathing, and any abnormal peculiarities in the mechanism of drawing in and expelling air. The lung is measured by a simple yet accurate apparatus devised by Dr. Coissard. The apparatus is constructed like a gasometer. A cylindrical tank is filled with water. Within that tank, but closed at the top, is a smaller cylindrical container, held in position by counter-weights connected with it by cords running over pulleys.

The air exhaled by the patient is conducted by a tube into the floating cylinder, and, by displacing the water contained in it, causes the inverted container to rise. A scale on the side of the tank indicates the volume of air exhaled. The chest expansion is measured with a tape-measure, and the movements of the diaphragm are recorded by two radiographs taken of the extreme positions of elevation and depression during the process of breathing. The force of exhalation is measured by a pulsometer, and the time of inhalation and exhalation by a stop-watch. Then the functioning of the larynx, lips, and other speech organs is carefully observed and noted.

The doctors give individual attention to each case, a detail of the treatment being massage of the throat by hand or by an electric vibrator

Each case is studied individually by the doctors. After a thorough consideration of the facts in each case, the method of treatment best suited to the condition of the patient is determined.

Breathing exercises are given first, to correct any defects developed by the nervous affection of the patients in their respiration. These exercises are supported by gymnastics of the arms and body.



Facing large mirrors, classes of patients are learning to pronounce the vowels *a* and *i*. After mastering the vowels the patients begin on combinations of vowels and consonants

To restore the normal functions of the vocal cords is far more difficult. After the patient has been taught to breathe properly, his throat is massaged by hand or by an electrical vibrator. By slow degrees the shell-shock victim is taught to emit sound at the time of exhaling.

First the Vowels

The patient begins with the vowel *o*. If he does not succeed in emitting the simple sound, his throat is gently manipulated by the doctor, who depresses the larynx of the patient with his fingers to stimulate and assist that organ in the effort of resuming its normal functions. These exercises can be taken for only a brief time each day.

After the patient has learned to pronounce the vowel *o* without assistance, he begins to learn how to pronounce the vowel *e*, which in French is pronounced like "ay" in the English word "bay." Then follow in the same order the vowel sounds *eu*, *ou*, *u*, *a*, and *i* as pronounced in French.

The last phase of the treatment includes the careful and systematic training of the muscles of the cheeks, tongue, lips, pharynx, and nose which present symptoms of paralysis. These exercises are performed by the patients in front of a mirror.

After they have learned to respond in an almost normal manner, the patients essay the pronunciation of simple combinations of vowels and consonants.

In most of these cases speech is restored in a few months.

A Rain-Coat for Man and Boat

Man and boat are enveloped in a big flowing cover

ONE man must have been deeply touched by sad tales of rowboats swamped in storms. He is Louis O. Anderson, and he has invented a "storm cover" for boats which, when adjusted, covers both boat and rower so completely that waves and rain will roll off it as water rolls off a duck's back.

The suit which includes a head-piece is made full at its junction with the rubberized cover, so that the oarsman may try to paddle with one of his oars while sitting in the stern with his tail spread out behind him.

His other oar makes a backbone for the cover. It rests in grooves in the wooden plates that hold the cover up. The plates curve down toward the boat-edge so that water will roll off. The cover itself is fastened down to the boat by a complicated system of bars, hooks, eyelets, and lugs, which prevents the smallest drop of water from entering, and also makes adjustments too difficult for use where quick action is necessary.

We are somewhat puzzled as to how the rower gets into his suit after he has adjusted the cover.

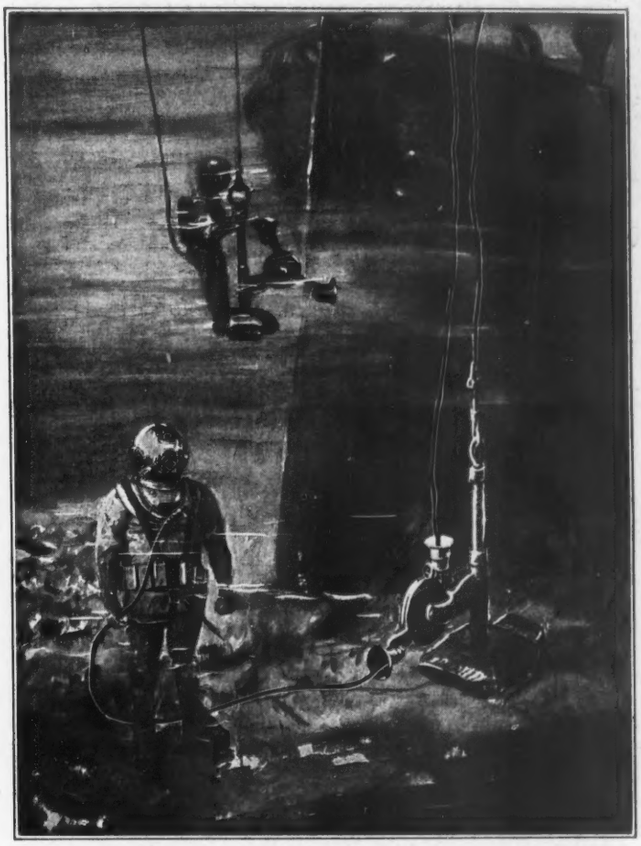
Keeping the Diver Down

WHEN a diver goes down one hundred feet or more he is pressed upon from every side by tons of water. The suit he wears is blown up with air not only for the purpose of enabling him to breathe but also for the purpose of offsetting that water-pressure. Otherwise he would be squeezed to a pulp.

This air-pressure forces nitrogen into the diver's blood. The nitrogen is not dissolved; it is held in the blood, like the gas in a bottle of beer or ginger ale. Pull the cork from a bottle of beer or ginger ale, and the gas bubbles up. That is exactly what happens to the diver's blood if he is suddenly pulled up from a great depth. The nitrogen boils off. For safety's sake he must ascend in very easy stages; the nitrogen must be allowed to escape very slowly.

Hermann Stelzner invented the diving gear shown in the accompanying illustration. As a rule, the diver descends by what is called a "shot-rope"—a knotted rope at the bottom of which a weight is attached. Stelzner gives the shot-rope a new form. When the diver wants to come up, he simply stands on Stelzner's weight and grasps the shot-rope.

Of course, strong currents will affect Stelzner's diving gear, just as it affects the type at present in use. But if you will study the accompanying drawing you will see that the pull is chiefly in a horizontal direction. In other words, the diver cannot be swept off his feet and carried upward by reason of the buoyancy of his inflated dress. Should the diver be forced up to the surface, he can be quickly pulled down again without the present necessity of deflating his dress to make it less buoyant.

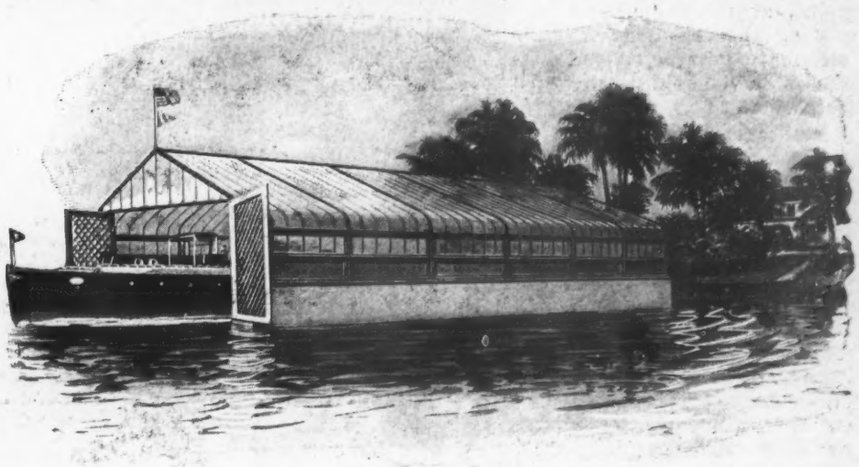


When the diver wants to be pulled up he removes the connection containing the life-line, etc., and steps on the weight

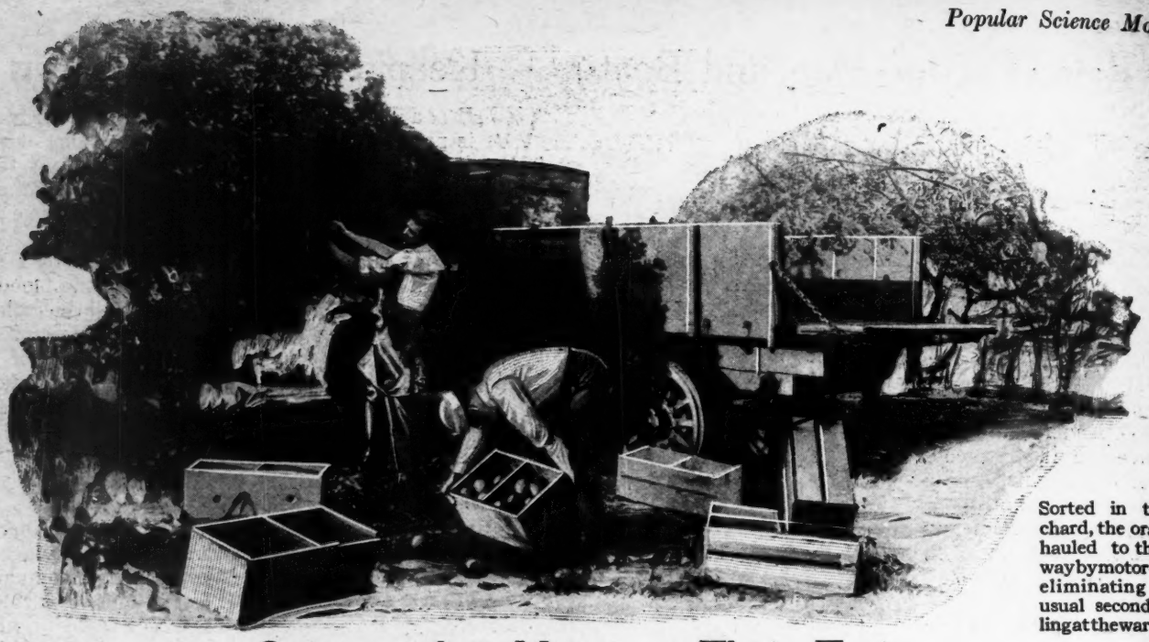
Housed in a Boat-House of Glass

WHY should a man want a glass boat-house? In the first place, for light. That, at least, seems to have swayed a boat-owner who spends the winter in Florida.

The architectural lines of the structure are clear-cut and graceful. Curved eaves and a sloping roof make an excellent watershed which will not mildew or decay. If necessary, the whole building can be washed down with a hose from top to bottom without damage to any part. The glass is frosted, and softens the direct rays of the sun.



Miami, Florida, has a neat boat-house made mostly of glass, with curved eaves and a sloping roof to shed the rain easily



Sorted in the orchard, the orange is hauled to the railway by motor-truck, eliminating the usual second handling at the warehouse

Oranges that Motor to Their Train

AS you plunge your spoon, at breakfast, into that luscious orange upon your plate, do you think about the care entailed and the long journey necessary for that particular orange before it is set in front of you in its present perfect condition?

At the orange ranch the oranges are picked by experienced men, who sort them into various grades, pack them carefully into boxes, and place them upon motor-trucks that travel fifty or even a hundred miles to the nearest railroad.

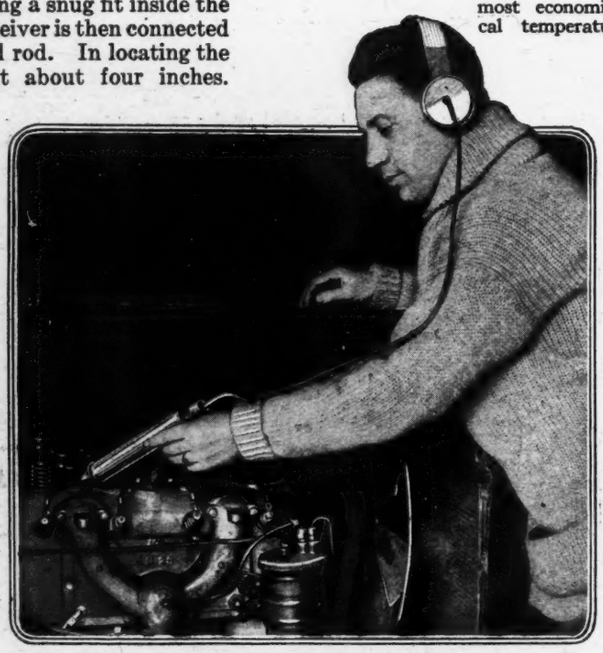
Motor-trucks play an important part in orange transportation, since by their use a second handling at the warehouse is entirely eliminated.

A Stethoscope for Engine Ills

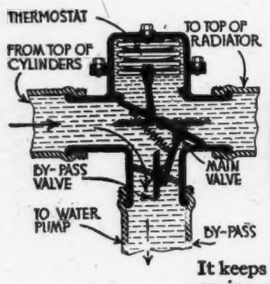
ONE of the intricate problems that an automobile mechanic has to deal with is distinguishing the various kinds of knocks that an engine is subject to. To do this successfully a listening apparatus is necessary, and the one illustrated below is easy to make and will serve just as well as the bought article.

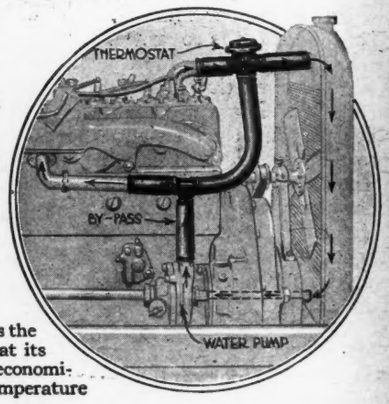
It is made of a ¾-inch copper tube about 8 inches long with a steel point welded at one end. In the other end a steel rod is inserted, making a snug fit inside the copper tubing. A telephone receiver is then connected by a wire to the end of the steel rod. In locating the knocks, pull the steel rod out about four inches. Touch the suspected part of the engine (when it is in operation) with the steel point, at the same time placing the telephone receiver to the ear, and the knock will be distinctly heard.

Loose connecting rods produce a sharp bump or a heavy hollow sound. Main bearings are readily located by running two cylinders of the engine at a time, one on each side of the crank bearing, producing a hard bump. A loose piston-pin gives out a sharp metallic knock. A loose fly-wheel will produce a heavy knock at low engine speeds and appear regularly. A loose piston gives a short, sharp knock, and loose tappets will produce a brisk tap.



An easily made knock detector that will locate engine knocks before they have a chance to develop into serious complications





It keeps the engine at its most economical temperature

Keeping the Chills from Your Engine

THIS thermostat is mounted in the top of a cross-shaped pipe, connected with a main valve in the horizontal part of the pipe, and this in turn with a by-pass valve in the lower part of the pipe.

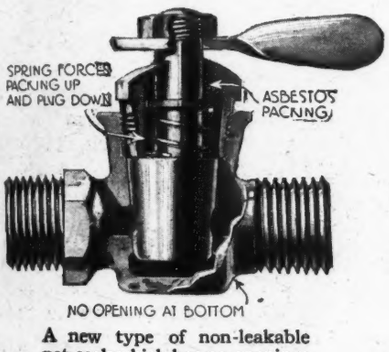
When the water in the cylinder-jacket reaches a temperature of 170° F. the diaphragm of the thermostat expands and opens the main valve, so that the water circulates through the radiator as usual. The by-pass valve is then closed. As soon as the water drops below 170° the thermostat diaphragm contracts, closing the main valve and opening the by-pass valve.

A Really Non-Leakable Gasoline Pet-Cock

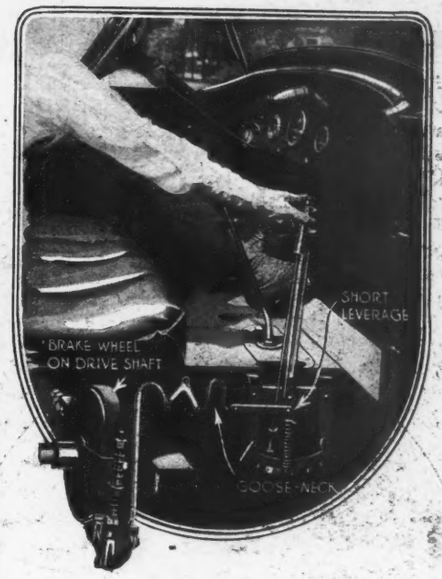
IT is the small losses of fuel, the little drops from a gasoline line, that, taken over the period of a year, amount to many gallons.

One of the sources of small leaks on a car is in the pet-cocks in the gasoline line. When these cocks become worn from continued turning, there is often the slow *drip, drip, drip*, day and night, that finally affects the number of miles per gallon secured.

Troubles of this kind would be eliminated if every car were fitted with the new type of non-leakable pet-cock shown in the picture below. There is no opening in the bottom of the cock, and consequently there can be no leak there. The stem of the plug is packed so that it cannot leak at the top. The packing is of woven asbestos, and it is held in place by a spring, which simultaneously presses down on the top shoulder of the tapered plug, so that it is at all times kept on its seat.



A new type of non-leakable pet-cock which has no openings that leak and waste gasoline



You can stop a powerful car instantly, without its skidding, with this brake

A One-Finger Emergency Automobile Brake

APPLYING the brakes of an automobile is almost as easy as pressing the key of a piano when the emergency brake of one of the new types of automobiles is used.

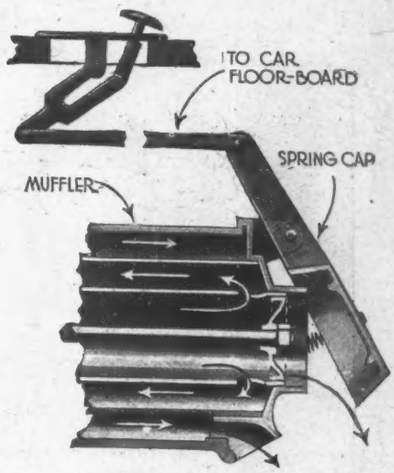
The ease with which the "one-finger" brake operates is due primarily to the fact that friction is applied almost directly, without cumbersome devices. A short rod attached to the lever near the pivot on which it turns connects with a goose-neck, which operates the mechanism that closes a clamp on the shaft through which power is transmitted to the rear wheels.

The New Safety Cut-Out for Ford Cars

A NEW type of safety cut-out, which can be fitted on any type of Ford muffler, deflects the exhaust gases downward instead of permitting them to shoot out horizontally and damage the spare tire.

It consists of a cover for the rear of the muffler. This cover has a circular opening at the center of the end and another opening at the bottom. The center opening is ordinarily closed by a cap operated from the floor of the cab.

Under ordinary running the exhaust gases are deflected downward out of the muffler through the bottom opening. When it is desired to use the muffler cut-out, the cap is simply opened by operating the foot-pedal and the gas is forced out horizontally.



A new Ford cut-out which deflects the exhaust gases down instead of horizontally

Painting Trucks by Compressed Air

"AND the entire axle was painted with one daub of the brush." What? You find that a bit thick? But that is just what is being done in truck factories that turn out immense production.

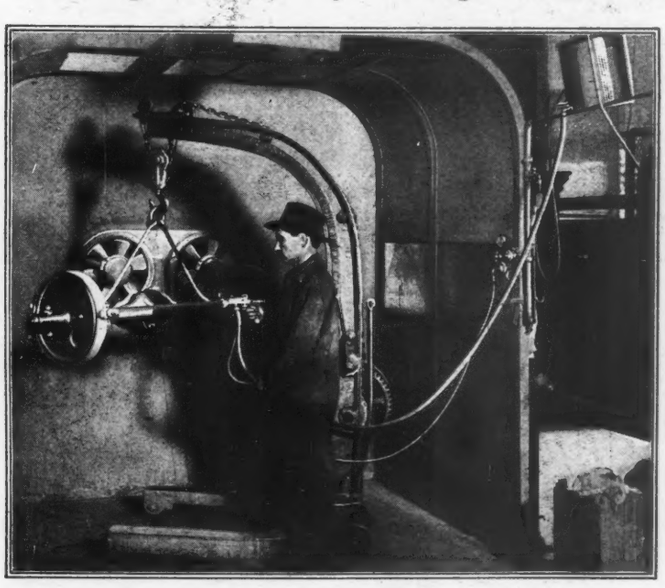
The work is done in a special compartment containing the painting apparatus. An up-to-date feature of this compartment comprises two electric fans designed to draw off the paint fumes and thus protect the operator from lead-poisoning.

As may be seen in the photograph, compressed air is utilized to force the paint from the nozzle, the paint being led down from a reservoir, placed high on the wall of the compartment, through a heavy rubber hose to the air nozzle held in leash by the operator.

After the crane has hoisted the axle to the desired position for painting, the operator, merely by a slight pressure of his thumbs, allows the paint to envelop the axle in a fine, thick spray which reaches every nook and corner.

After the axle has been covered thoroughly with paint it is taken to the ovens to be baked.

Where production assumes gigantic proportions, the value of a painting compartment like the one illustrated is easily realized, for it promotes economy as well as producing an efficient job.



In truck factories where production is based upon a big scale, all parts are now painted by compressed air in a special compartment

Making Over Last Year's Hun Helmets

Their material and shape will make them useful in places high and low

Down at the bar rail, where worthless men throw at it worthless things. It has fallen so low that it is just one step above the cuspidor

Up in the tree-tops it serves as a bird's nest *de luxe*. Yet the poorest little early bird can move in rent-free and raise her family

Tony's brother brought home two helmets. He gave one of them to Tony and the other to their mother. Now, Tony is a cobbler and uses many nails. He turned his helmet upside down and made a tray to fit it. In the tray he keeps small nails, in the helmet large ones

Tony's mother is industrious and neat—note the lace edging on the shelf over the stove. She is also economical, and so, instead of hanging her helmet over the parlor mantel, she has brought it into the kitchen, and boils in it the family potatoes

The flowers that bloom in the spring have nothing to do with the pot. These are flourishing in a most unattractive old thing—a German helmet. These helmets are very useful, they balance so beautifully

Photographs © Kadel & Herbert

When There's Sickness in the Circus

A bad case of paralysis of the trunk. The doctor never knew that elephants' trunks would paralyze, so he rather doubtfully bandaged it. He is waiting for signs of life

In the best of health now, but apt to play sick as soon as he sees some other monkey getting attention. Monkeys have as many real and imaginary ailments as do some of the "idle rich"

The worst of dosing a camel with medicine is that he may either use it or tuck it away in his pouch for future reference, thereby either getting well or sicker

If an elephant insists on having his toe-nails pedicured, his valet will have to use a saw: that's about the only tool that will sink in

He looks what happens to him; can't feel any worse inside the bag than out of it; might as well get in

He's a wildcat, and he's not going to let any sore paw tame him down; rather does it make him wilder. He would joyfully bite and scratch the hand that dresses him

Piloting a Steamer with a Trolley Line

Should this plan be found practicable there would be no more collisions in foggy weather

By F. W. Fitzpatrick

HAVE you ever stood on the deck of an incoming ship in a fog? Did you notice how anxious the captain was? Did you watch a man time and time again heaving the lead? Do you remember how carefully the ship felt her way?

She was in dangerous water, and her navigators fully realized it.

It is not the fog alone that is feared. Fog not only prevents the lookout from seeing, but it distorts sound as well. You hear the blast of a "siren" or the ringing of bells, but you cannot safely judge of their distance. Sometimes the sound is lost altogether. Fog-horns mark dangerous points, and a navigator must guess not only where that fog-horn is, but just how far he has to keep away from it. So with ships.

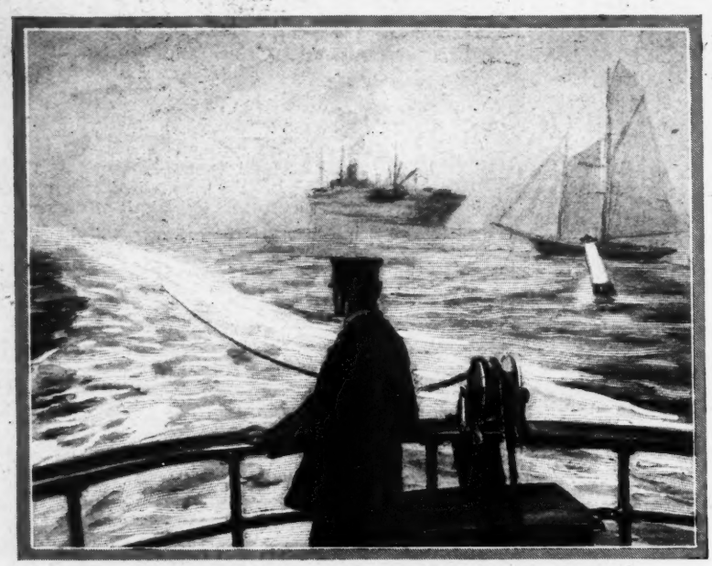
Often I have heard a warning whistle, and imagined a ship well to port or starboard some distance off, only to have my hair raised a moment later by seeing a great black hull looming up perilously near and on the other side.

Perils of New York Harbor

A few weeks ago I spent three hours getting from Sandy Hook to Tompkinsville, in New York harbor, and that with one of the best pilots thereabouts. We merely crept along, for we knew that three vessels must be near—knew it without doubt by the number of distinctive whistles that we heard.

Off Fort Hamilton the fog lifted for a few minutes. There were thirty-four vessels in sight, five very close to us. Almost across our bow was anchored a bell-ringing sloop of whose presence we knew nothing. Three big liners had wisely anchored; they had been there, I was told, for more than seven hours.

All this means an enormous waste of time. The cost of such delay must amount to hundreds of dollars a day in the case of a large ship, not to speak of the terrible risk to which every vessel and its crew are exposed. The inventors have tried to help out the shipowner and the shipmaster with their contrivances. Here are some of the ideas that have been suggested:



The amount of line to be paid out will indicate the depth of the channel the pilot is in, and so he will direct from the stern instead of from the bridge, the pilot's usual vantage-point

Continuous lines of lighted buoys, electric indicators, and channel-finders of various sorts, even an electric trolley system and under-water tracks. Most of these inventions are impracticable; some would actually obstruct navigation in fair as well as in foul weather.

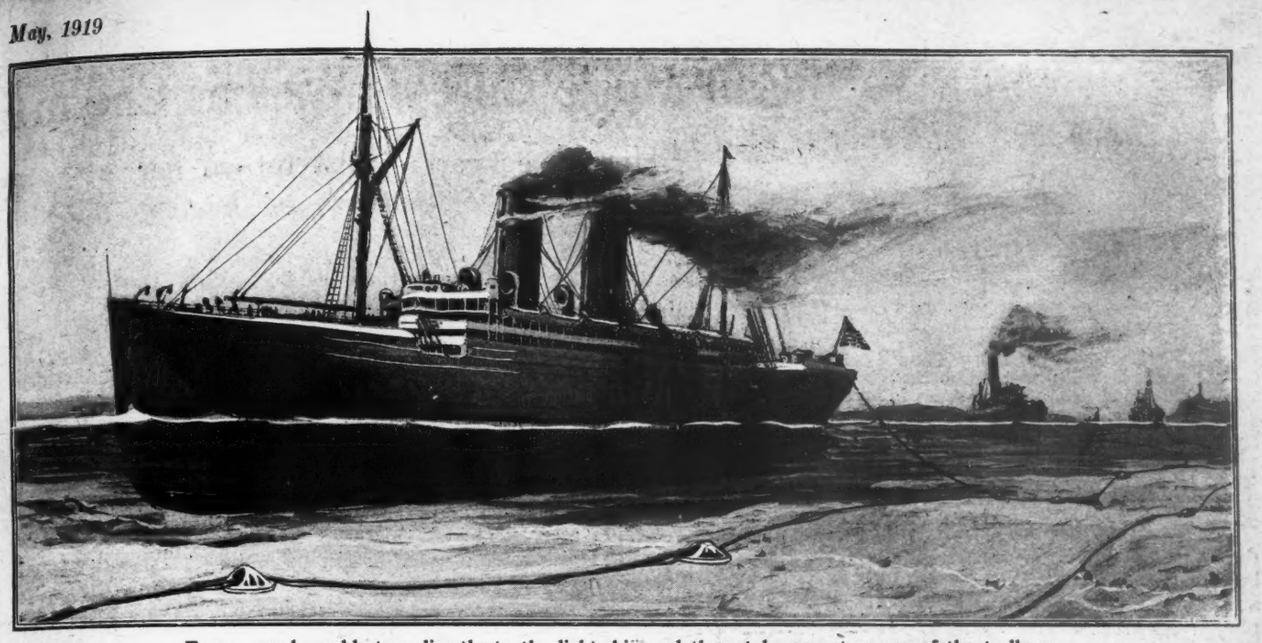
What My Suggestion Is

Let me now offer a suggestion of my own. I have not patented the device, and I do not even know whether it is patentable. I offer it to the public.

The trolley car suggested my invention. I would lay a heavy wire cable from some convenient point in a harbor to a point at the mouth of the harbor where there is deep water and sea room. This cable I would continue back, at a safe distance from the other course, a half mile or so, to the point of departure, and there splice the ends. We would have a continuous cable, a loop, anchored at suitable distances, so that it could not be torn away and become a source of danger.

The light-ships, one at either end, mark deep water. The line that I

If the day comes when vessels pick up a trolley instead of a pilot, one more picturesque feature of ocean life will be lost to those who go down to the sea in ships



Every vessel would steer directly to the light-ship and there take on astern one of the trolleys; the vessel would then proceed under her own steam, dragging her trolley along the main cable

have described would be that of the channel.

The light-ship at the sea end of the cable would be equipped with the most powerful fog-horns, bells, guns, or other noise-producers that scientists prescribe for use in a fog. These instruments would not be a warning of danger, but a call to safety. Every incoming vessel would steer for the light-ship.

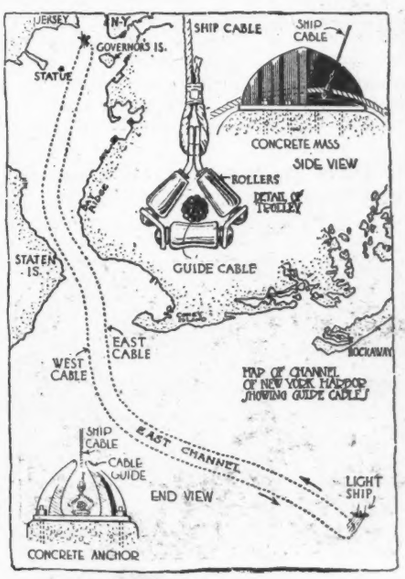
On this cable would be a number of specially devised rings to which other and lighter lines would be attached. These lines, or trolleys, would be buoyed at a length to insure floating in maximum water—125 feet or so. Thus they could be picked up in case of loss or breakage. There would be a sufficient length of cable or trolley line tc cover the angle of drag and varying depths, and for handling slack, etc.—in all, say six hundred or perhaps seven hundred feet of line. All of these lines, by a sufficient number of rings, would be held on this "safety" light-ship, and a similar number of them on a tug or other boat at the shore end of the loop.

Necessary Harbor Regulations

In foggy or thick weather, or for that matter at all times, a harbor regulation would prohibit all sailing-craft from entering or anchoring inside of this sixty-foot depth, unless in tow of a tug or steamer. Another regulation would compel every tug, boat, and steamer to steer directly to this light-ship and there receive one of the trolleys. In calm weather it could be handed over by a lighter "casting line," such as is used in handling heavy landing or tow lines, and in rough weather it might be shot across a vessel's bow. But there is rarely a sea on in a fog. A heavy sea means wind, and wind means no fog.

In my plan for piloting ships, the trolley is taken on astern. The vessel then proceeds under her own steam at a safe rate, dragging her trolley along the main cable. As long as the pull is fair astern the ship is on the right course.

Naturally, the master will have to allow for drift, currents, and the angle of descent his trolley line indicates, but the procedure will be a thousand times safer and easier than constant sounding and the guessing he has to do now. He has the assurance of being safe. No one can run into him sideways. He will have to watch so that he does not run into the vessel ahead of him, and to make noise enough to insure that the ship following him will not collide with him astern. It is the same as navigating a cable car, minus the inherent dangers of the cable and the passing of teams and people.



The author's plan is to lay a heavy wire cable from some convenient point in the harbor to a point near its mouth

The Pilot at the Stern

The amount of line paid out indicates the depth of the channel the pilot is in, and tells him positively where he is. In other words, the pilot directs from the stern instead of from the bridge!

Each vessel should have an automatic steam-drum adjusted to the drag or pull of the ring along the main cable, so as virtually to lift the cable a trifle, but not enough to drag it or raise it more than to allow the passing of the ring under its under surface. By means of adjustment the angle will be maintained, the cable being paid out or in according to the varying depth, but steam being shut off at the maximum depth and the slack line being paid out loosely until the vessel is stopped and the trouble investigated. If the line is made fast to the vessel, any catch or accident means the breaking of the trolley line or damage to the main cable or its anchors. Such a machine would make it possible to handle a 14,000-horsepower vessel as easily as the smallest yacht.

All incoming vessels would follow the right cable and deliver over their trolleys to the tug or other boat charged with the mission of receiving them at the shore end of the loop. Outgoing vessels would receive these trolleys from the tug, and follow their trolleys to the light-ship at its outer end—a system of double-track street-cars, pure and simple.

Working on a deaf man. The man places his forehead on the lid and his hands on the sides of the instrument, while the pianist plays major chords very loudly

Can Music Cure as Well as Charm?

How a concert pianist turned her music to the business of healing

By W. T. Perry

HAS music a new and hitherto little recognized curative value? That different emotions are excited by different sorts of musical strains has been appreciated since first Pan played his reeds. The easy cadence of waltz time invited our fathers and mothers to dance, just as the sound of the so-called "jazz" prompts the present generation to step and glide or slide about. The snap of military march time quickens the pulse. The soft crooning of some Southern mammy lulls to sleep a tired, fretful pickaninny.

Miss Anderton's Theory

Miss Margaret Anderton, a concert pianist, and the originator of what she terms the *piano causerie*, which consists of prefacing each program number with a few cleverly chosen words with the idea of creating a better understanding of the numbers played, has studied the sedative and, in what she believes to be an astonishing number of cases, the curative properties of musical sound vibrations. Miss Anderton had been making an analytical study of the effects of musical sound vibrations for some time when the war came. She was in Canada at the time, and she became strongly impressed with the belief that she could make use of her ideas in helping soldiers who were wounded or victims of shell shock.

Perhaps her own words describe the work best. She says:

"The concert artist should use her skill for the scientific application of music as a medicine under a doctor's prescription, a different matter from simply playing music to soothe or divert.

"It is high time that art became altruistic. Musico-therapeutics should not be a commercial asset. The artist, giving of her highly trained abilities to the service of science and the medical profession after years of private research work, feels profoundly the use of music as a curative means. The procedure is psychological."

Teaching a man suffering from shell shock to play the xylophone. At first he is almost afraid to strike the instrument, but, gradually becoming more and more confident, recovers his mental poise

The purpose of musico-therapeutics, therefore, is curative. It is not an entertainment. It is not to play to invalided soldiers just to pass the time away, merely to amuse and please them. Music is to be administered with a definite, scientific purpose, and only after careful study of the medical reports of each individual case and of the patient's physical history.

Different sound vibrations produced by different musical instruments, different keys, and different time are selected for each individual case.

Thus a man who had been a structural carpenter, and who was a victim of shell shock, was patiently taught to play the xylophone. At first he hesitated to strike the bars even gently. Step by step, he was persuaded lightly to tap the keys, and later to pick out "God Save the King," a tune he remembered. Soon he was hammering away lustily, and, incidentally, recovered his poise. Another interesting case was that of a soldier who, after a high-powered shell had exploded near him, although he was untouched, believed himself deaf.

A man who had lost the use of three fingers was taught to play with two fingers; as a result the paralyzed fingers became almost normal

Distinctly Not for Enjoyment

This man could hear absolutely nothing. After inducing him to place his forehead on the piano-top and to press his hands against the sides of the instrument while loud major chords were played, his hearing became acute.

As Miss Anderton points out, music so played is not supposed merely to be enjoyed in the way that normal, well folk enjoy music. It is rather that the tone vibrations, varying in quality, rhythm, and intensity, may, when properly applied, alleviate and often cure neurotic conditions.

If You Must Smoke While Wearing Your Influenza Mask

IT is all very well to use an influenza mask. But what if you want to smoke? Edward T. Duncan has supplied the answer.

First, buy two corn-plasters at a drug store. You may not see the relationship between a corn-plaster and the influenza. Wait a minute. Hasn't the plaster an opening for a corn? Well, that hole can be made to fit a cigar or a cigarette. Paste one of the plasters on the inside of the mask and the other on the outside, as shown in the picture. Extend the hole of the outside one clear through the mask. The other plaster is put on merely for beauty; it provides symmetry.

When you draw on your cigarette, all the little germs hovering around take advantage of the chance and try to get in. But when they have gone through the fire of your cigarette they become purified, and are quite harmless by the time they get to your lungs.

When you are not smoking, the open plaster is plugged with a cork. This is to conform to the law in localities where the authorities think that influenza can be cured by legislation.

You must remember not to stick out your tongue, and to be very careful when you sneeze lest you blow out the cork and let in the germs.

Duncan, the inventor, at first thought of having an outlet for the exhaust smoke, but he found out that such refinements would violate the law. On second thought, he concluded that there was double enjoyment derived from swallowing the smoke a couple of times.

Smoke if you want to, even though you wear an influenza mask. Corn-plasters fitted to the mask, inside and out, supply the necessary hole

A young mechanic spent a year constructing this 300-pound church model from bits of steel and brass

He Has Revived the Lost Art of Church Modeling

A BROOKLYN mechanic has spent more than a year making a church out of bits of steel and brass. A chisel, a hammer, and a file are practically the only tools that he uses. The height of the model is 53 inches, the length 32 inches, and the weight is approximately 300 pounds.

Chimes and an eight-day clock movement have been installed in this miniature church. They resemble somewhat those of Westminster Abbey. The clock strikes every fifteen minutes, and the chimes ring on the hour.

This Stone-Spreader Does the Work of Many Shovelers

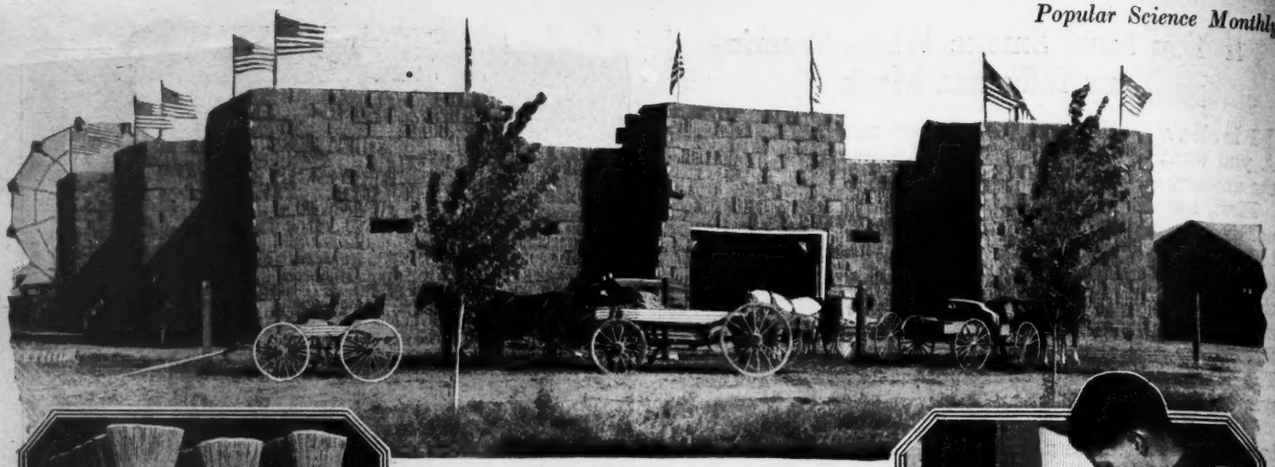
INSTEAD of dumping stone at the side of a road, much time and money can be saved by spreading at the time the stone is dumped. Contracting two operations into one is, as a rule, economical, and the present is no exception. The construction of the device used for spreading is neither difficult nor expensive, and the cost is often made up by the gain in the first contract.

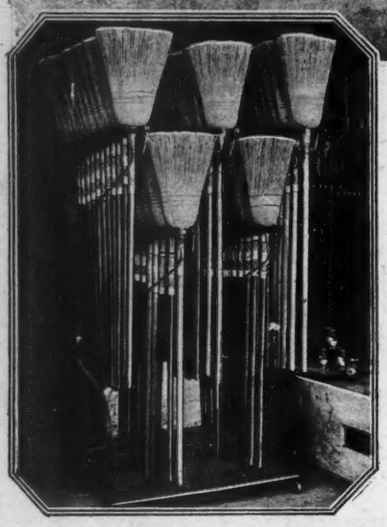
When crushed stone is delivered by truck, the spreader is fastened behind. The body is raised and tilted for dumping, and as the stone pours out upon the highway the spreader levels it to an even depth, the extent of which is determined by the operator. The machine is seven feet four inches long, and can be used in connection with any of the standard types of trucks.

A drag is used with the spreader if the road is only slightly wider than the spreader

When a road is too wide to be covered at one operation, but not wide enough to permit of two, a drag is attached to the spreader, which drag scatters the stone on both sides for an additional space. The action is almost entirely automatic, and unskilled labor can use it as readily as skilled.

At this time, when every effort is being made to build up an extensive haulage system, any advance in road-making is important.





Canny Farmers Planned This House of Hay

SOME farmers of Sunnyside, Washington, had about six hundred tons of hay which they wanted to sell at just about the time the annual county fair was due. They suggested that the fair building be made of hay, and then graciously offered the use of their bundles.

The hay house was a large square structure, twenty-five feet high. Inside there was plenty of room for all exhibits, a rest-room, an information bureau, and a stage for the customary vaudeville show.

When the fair was at its height, the kindly hay-lenders suggested that the hay be auctioned off; and the happy visitors bought it all, paying a very high price for it.

Brooms in Perfect Formation

PROBABLY the largest thing you can get today for a dollar is a broom. That is all very well for you, but dealers begrudge the space that brooms take.

A broom-rack like the one shown above holds sixty brooms. It takes up very little room in the dealer's shop, and the wheels on it make it an excellent push-cart. Wires running from front to back keep the brooms from swinging from side to side and getting mixed up with one another when the rack is in motion.

Typewriting on a Bureau Drawer

A BED, a bureau, and a chair are about all the furniture usually found in a so-called furnished room. The inspired typing author sojourning in one of them finds no place in which to stand his machine. The window-sill is too narrow, the dresser-top too high, the chair too low, and the bed too wabbly.

One man discovered that a bureau drawer made an excellent resting-place for a typewriter if the contents were dumped out and the drawer put back in the groove, bottom up.

There Are Pipes in the Pipe

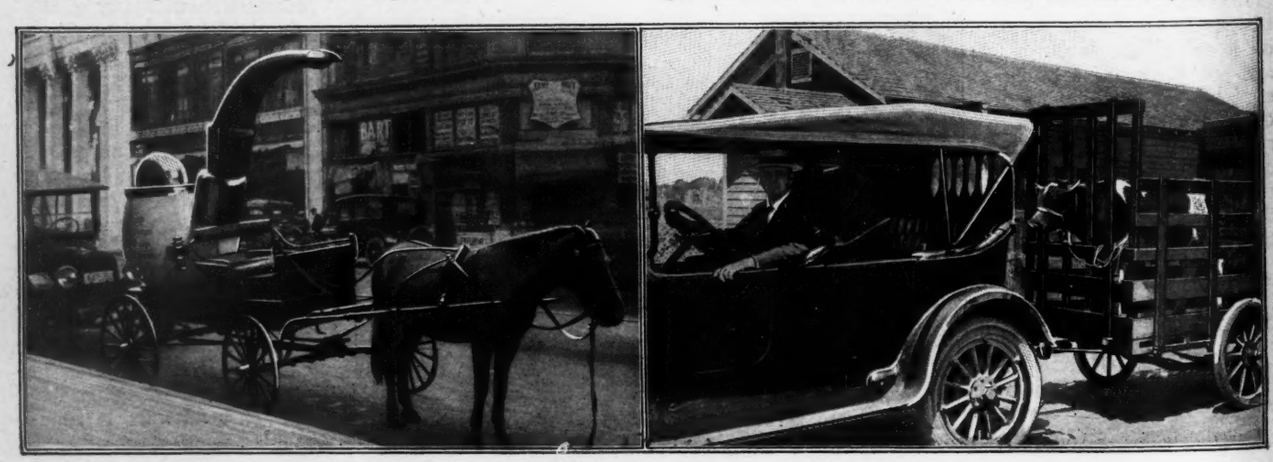
SINCE Los Angeles has been captured by moving-picture companies, an ordinary merchant must do much queerer things than the movie people to attract attention.

Now, a man named John had a pipe shop there, and he wanted everyone to know it. So he built a metal pipe ten feet long from the tip of the stem to the bottom of the bowl. He mounted it on his delivery wagon, and uses the bowl for carrying packages. On the bowl's outside he naïvely confesses that "The shop that John keeps is the shop that keeps John."

How to Take Your Pig to Market

YOU really can't put a calf, cow, or pig in the back seat of your automobile if you have any sense of the fitness of things. Yet you can't expect any one of them to trot patiently behind, even if you throw a rope around its neck. How, then, are you going to deliver animals after you have sold them?

James McAlister, of California, answers this question by building the animal trailer shown below. The back piece on the wagon is dropped down to make a gang-plank when the animal gets on or off. Mr. McAlister's bull doesn't look very happy.



Ex-Subjects of the Ex-Kaiser

GERMANY has lost since 1914, besides other things, seven million Africans like those in the picture below.

Judging from the primitive way in which they live, politics doesn't bother them much and they don't care who owns them. The men hunt their own meat in the forest in which they live, and the women cook. The one with a pole in her hand is pulverizing grain for bread.

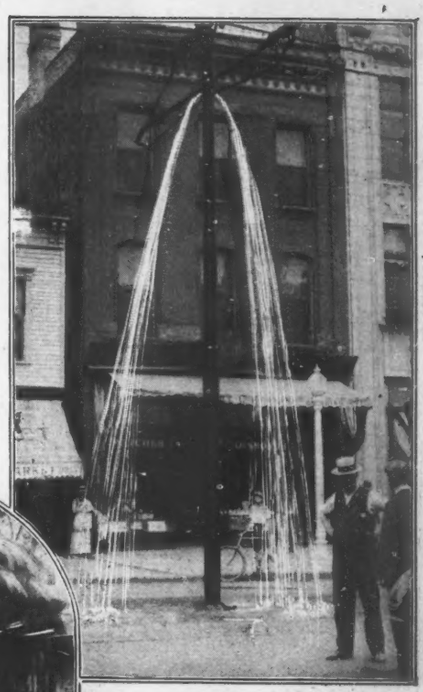
When these Africans want to buy beads, they pick some tobacco leaves (shown up front) and use them for money. They live in huts built on stilts to protect themselves from African mosquitoes, which hug the ground.

© Underwood & Underwood

You've Often Heard of Hearts of Stone

STONES have a disturbing habit of assuming human shape. Noses are their favorites, and a great deal of excursion money has been spent for the purpose of seeing these rocky noses. But the stone shown above, which is found in the San Bernardino Mountains in southern California, is too sentimental to bother with noses. It has a large heart, and it wears this heart where everyone can see it.

This heart of stone holds thirty feet of water; yet many sentimental folk have braved death through drowning therein, in order to carve their names on the heart's sides.



The Tale of a Leaky Trolley Pole

A TROLLEY pole was erected in Chicago. It was just like any other trolley pole—made of cast-iron with a hollow center and set in a concrete base. It had been up but a very short time when water started spouting from its top in two thin streams, and continued to spout.

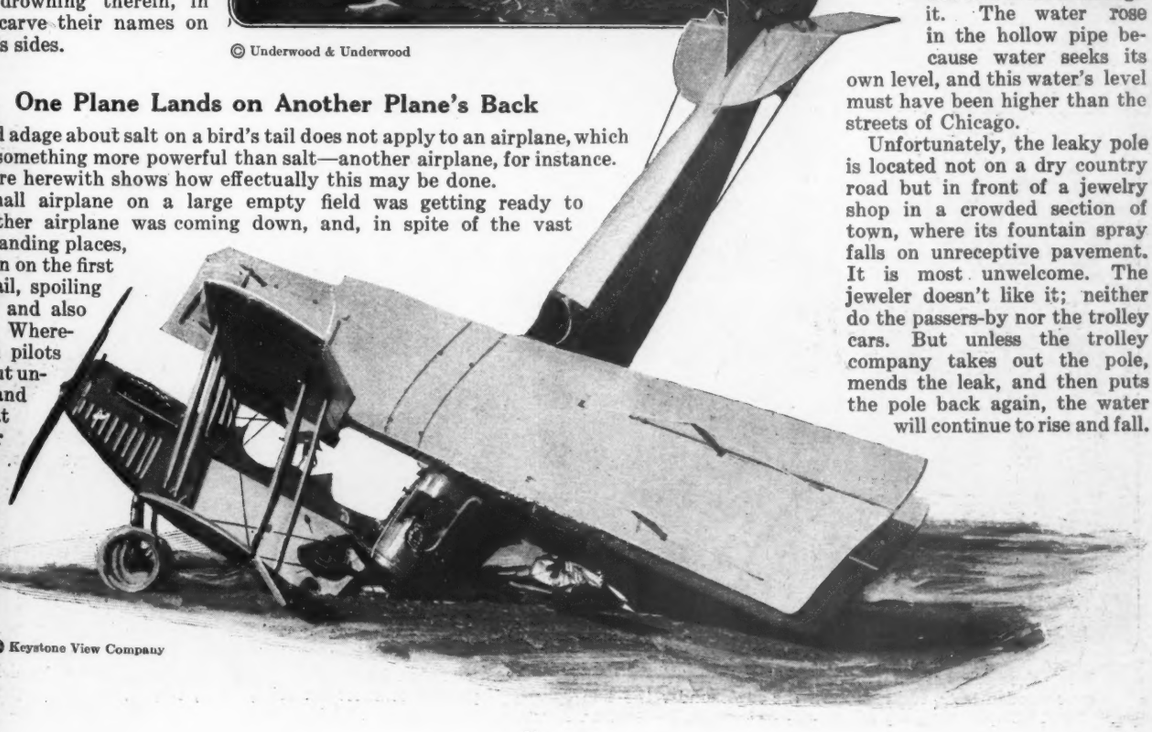
The trolley company asked the Department of Public Works to find out what the trouble was, and this was the answer: the base rested on an old water-pipe and had broken through it. The water rose in the hollow pipe because water seeks its own level, and this water's level must have been higher than the streets of Chicago.

Unfortunately, the leaky pole is located not on a dry country road but in front of a jewelry shop in a crowded section of town, where its fountain spray falls on unreceptive pavement. It is most unwelcome. The jeweler doesn't like it; neither do the passers-by nor the trolley cars. But unless the trolley company takes out the pole, mends the leak, and then puts the pole back again, the water will continue to rise and fall.

One Plane Lands on Another Plane's Back

THE old adage about salt on a bird's tail does not apply to an airplane, which needs something more powerful than salt—another airplane, for instance. The picture herewith shows how effectually this may be done.

One small airplane on a large empty field was getting ready to fly. Another airplane was coming down, and, in spite of the vast choice of landing places, came down on the first plane's tail, spoiling its flight and also its tail. Whereupon both pilots crawled out unharmed and looked at each other in astonishment.

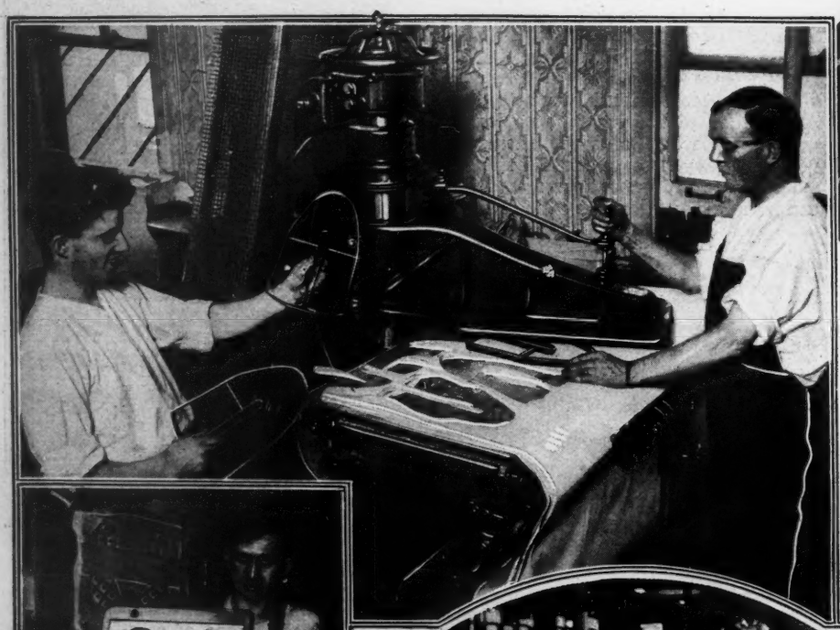


© Keystone View Company

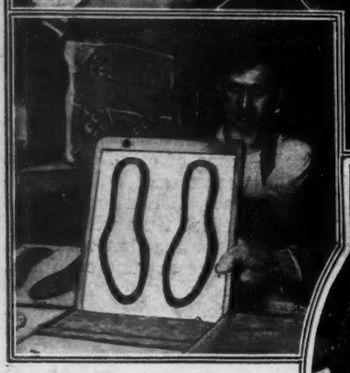
Not a Bit of Leather in These Shoes

The mechanical cobbler takes on the canvas shoe and reduces the labor to a minimum

The patterns of the uppers are so laid upon the sheet canvas that every available inch of space is utilized. There is practically no material wasted by this method



The assistant at the left of the illustration is shown holding the knives that cut through twenty thicknesses of material at once

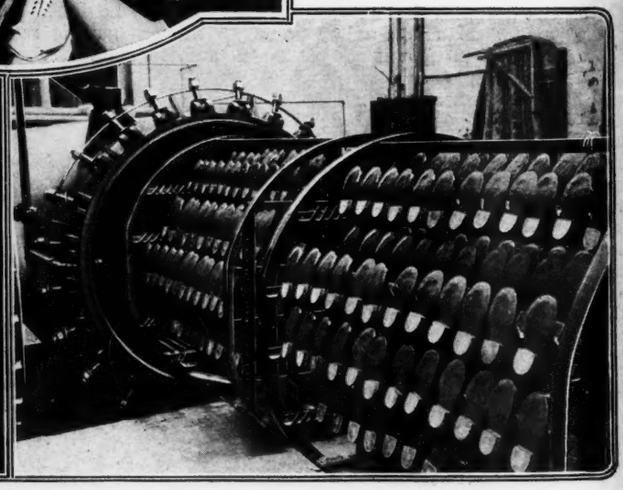


One of a pair of hinged plates between which slabs of rubber are pressed to shape them into soles. The surplus rubber is thrown back into the mixer and melted again

A mechanical Jess Willard that delivers twenty punches to the eyes every ten seconds is an ingenious machine which clinches the hooks and eyelets into the uppers

Photographs
© Publishers' Photo Service

When the uppers are made this machine pulls them smooth over wooden lasts, turning down the edges under the sole

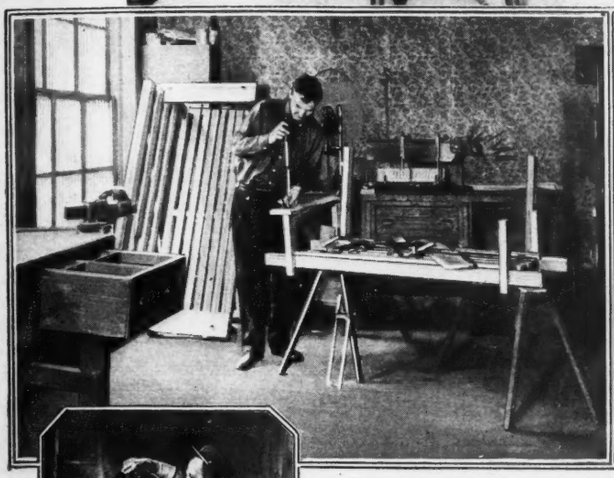


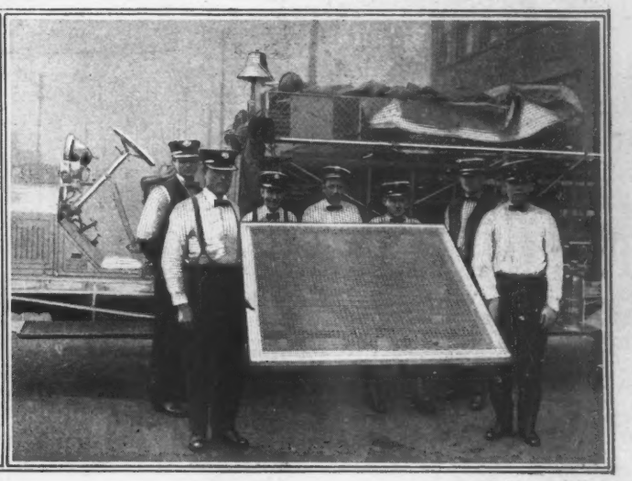
The shoe finally goes to the ovens, where the vulcanizing process cements the soles, heels, edging, and other parts

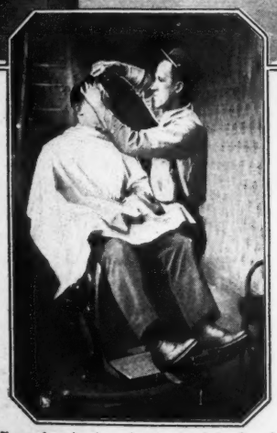
What They Do When There Are No Fires to Fight

Six men with but a single thought—promotion; and so they are reading books on building construction, fire prevention, and anything else that will help them

These seven serious souls are proudly holding a framed shawl which they all conspired to make. They have generously decided they will give it to the Red Cross



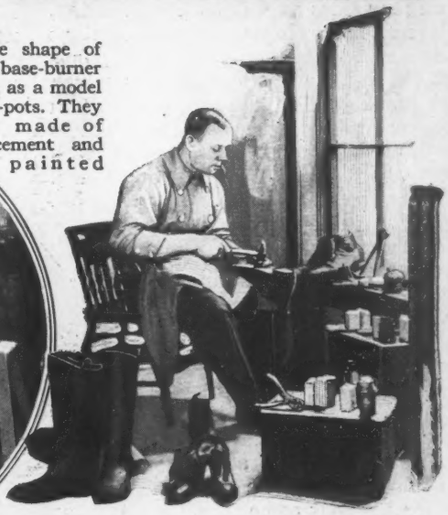




When he isn't playing with fire he plays barber and cuts the hair of his comrades, even unto his chief

If no fire inconsiderately interrupts him he turns out one porch swing a day, increasing his income by selling them

Intrigued by the shape of the base of the base-burner stove, he uses it as a model for flower-pots. They are made of cement and painted



His side issue is cobbling. When he has mended and patched the boots of his fellow firemen, he fixes the shoes of his family, so that no one can say, "Who is worse shod than a shoemaker's wife?"

They take turns rescuing each other from imaginary fires to keep in trim. The rescuers carry the rescued over one shoulder, flinging an arm around the victim's leg and holding hands with him

Goldfish breed well in wash-tubs and dish-pans. Perhaps the best place of all is a tank sunk in the back yard

Take a Little Joy to the Goldfish

By Edward F. Bigelow

IN investigating any phase of life, one should keep as near to nature as possible. Thus the ordinary little fish-globe, usually strung up in a window by three cords, is about the biggest monstrosity that it is possible to conceive. It could not be further from nature's method: pools and ponds are not hung in mid-air.

The ordinary aquarium, lighted on all four sides as well as from the top, is not much better, because nature does not light her pools and ponds in that way. The best thing in which to breed goldfish is a tub, pail, or pan in your back yard, where there will be a limited amount of sunshine. Perhaps even better are sunken tubs and tanks. These should contain various aquatic plants, and should be so located that the trees afford just the proper alternating glints of sunshine among the shadows.

Goldfish are bred in the spring. The percentage of fancy fish that breed true to type is small, but in this is a great fascination. It has been claimed on good authority that one should be satisfied if ten per cent come true.

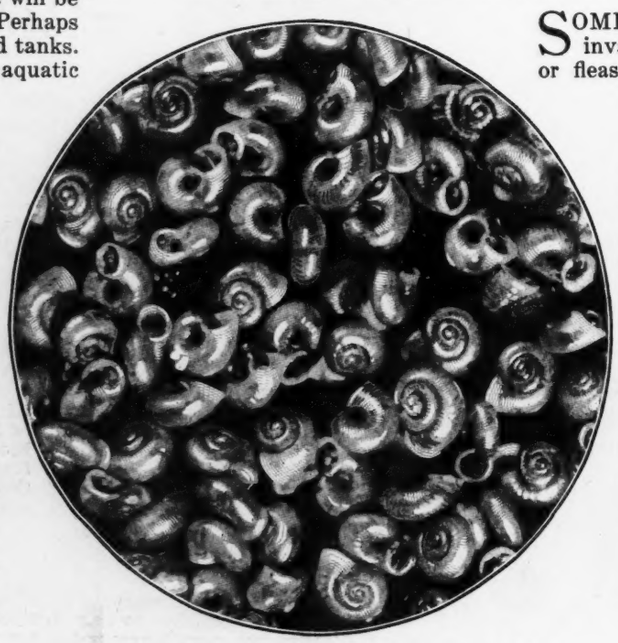
Good, hardy, outdoor stock may be obtained most cheaply in September and October, when the dealers are usually willing to sell their older fish. It is a good plan to get everything started in the autumn, so that all will be in readiness for the first signs of breeding in March of the following year.

Spawning fish should be well fed, but it is not necessary, as some people think, to feed them every hour in the day. Breeding fish should be kept in the proportion of about three males to one female—though if special results of crossing are desired only one male should be used. The tubs or tanks should be well supplied with aquatic plants. Make sure that there are present no snails or other enemies to the eggs.

Water hyacinths, myriophyllum, and similar plants with finely divided leaves are useful. The eggs are dropped on these plants and the sticky globules adhere to the feathery leaves. A good female will lay more than a thousand eggs.

There is a never-ending source of amusement in watching through a microscope the progress of the fish embryo during the time of hatching. This takes from three to fourteen days.

Warring Snails Have Invaded a Town



The whole town of Sidney, Ohio, is coated with snails like these. This picture shows them greatly magnified, each snail being no larger than a pin-head

SOME time ago Sidney, Ohio, was invaded—not by Germans, frogs, or fleas, but by slow, stupid snails. They were very small, no larger than a pin-head, and they came so slowly and silently that they had taken complete possession of Sidney before Sidney realized it. Their official name is *Vallonia puchella.*

This is how they were discovered: two Sidneyites walked along the street together. Said the first to the second, "It seems as if the sidewalks were covered with powdered glass; don't you feel it crunching under your feet?" The second one pulled out a microscope, and they both knelt down. What they saw was a solid coat of very small snails. The sidewalks were completely covered, and so was the rest of the town.

Snails are vegetarians. Hence this army menaces the growing greens of Sidney.

"She Starts, She Moves, She Seems to Feel—"

The intricacies of ship-launching explained

By Joseph Brinker

A BROKEN bottle of champagne or water; cheers; the smell of smoking grease; fluttering flags; the excited shouts of invited guests and of the workmen whose toil has completed the vessel as she splashes into the water—these are the outward or visible signs of a successful launching.

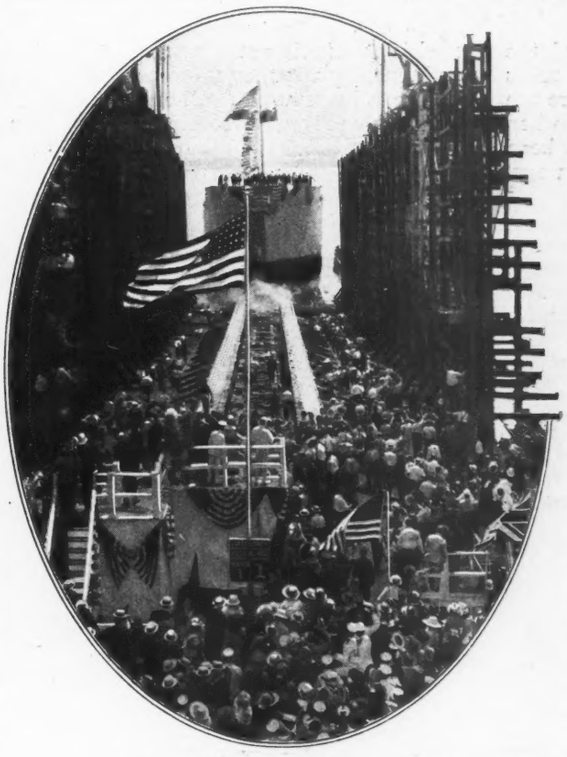
To the average spectator at a launching the thing seems very simple. The sponsor gives a signal, it would seem, when she is ready to break the bottle on the vessel's bow, and then something or other happens to start the vessel on her path to the near-by water.

Contrary to the general opinion, the sponsor does not give the signal to the workman when she is ready to break the christening bottle over the ship's bow. Instead, it is the workman who gives the signal to smash the bottle when he himself is prepared to start the vessel on her way to the water.

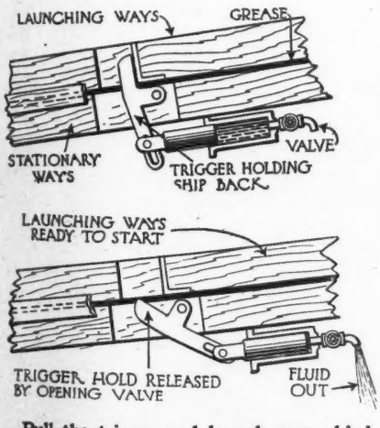
Rehearsing the Christening

To be sure that no slip-up occurs at these functions, the christening party is usually rehearsed the day before. A dummy bottle is used. But there is a right and wrong way of breaking the bottle. Miss Flora must watch for a signal from the man in charge, and break the bottle on the cord against the bow of the ship as the big hull begins to move. But she must not wait too long. Unless she swings it in just the right way, the bottle will not break, the hull will get beyond her reach, and the ship will go unchristened.

Seamen believe that a ship is hoodooed at the start if she is not properly christened. In the launching of a government supply boat, recently, a young woman was saved from this embarrassment by the quick wit of a workman on board the hull. While leaning over the bow, he saw that she had not broken the bottle, and by "snapping the whip" he did the actual christening for her. He received a gift of ten dollars for his quick thinking.



Just taking the water. A typical scene at the launching of a government-built ship. It all looks easy enough to the crowd of spectators looking on



Pull the trigger and launch your ship! This is the latest thing in launching methods. The "trigger," fastened to the stationary ways, holds fast the launching ways until a valve is turned to let out the liquid, thus releasing the trigger and starting the vessel on its first voyage. Each side of the ways has its own trigger

Two Ways of Launching

Two general methods are employed in launching a ship: the one endways, stern first, and the other sideways. Each method has its own particular advantages. Along the Great Lakes more boats are launched sideways than endways.

But, no matter on what plan the vessel is launched, there are certain fundamental principles that hold good in any case. The first work is the placing of a series of keel-blocks arranged in one line perpendicular to the water in the endways method. The height of the tops of these blocks is so arranged as to form a straight line of support for the vessel throughout its longitudinal length.

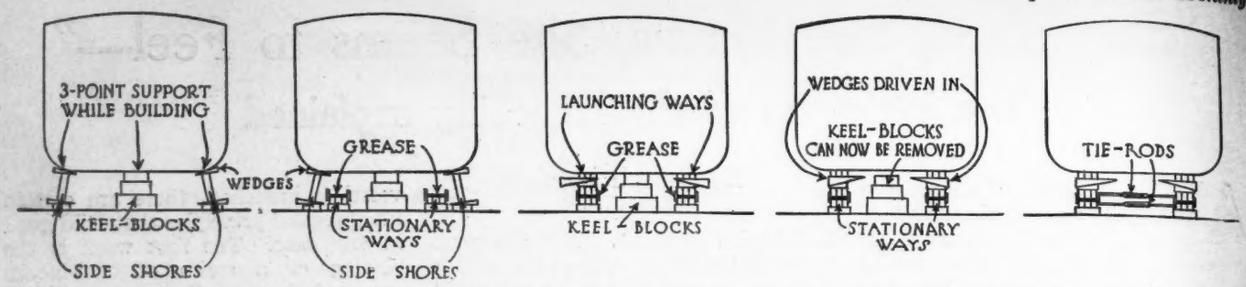
Shifting Thousands of Tons

These blocks support the entire weight of the vessel at its center line. The weight at the sides, as shown in the first of the diagrams at the top of page 40, is taken by side cribbing or shores. These keel-blocks and side shores carry the entire weight of the vessel while she is being built. Looking at the keel-blocks from the side of the vessel, those at the front are higher than those at the rear, so that the boat is built on an inclination, in most cases of about three sixteenths of an inch to the foot.

To launch the vessel, its entire weight is transferred from the keel-blocks to the launching set up on either side of the keel-blocks at an inclination of about one quarter inch to the foot. This transference of the vessel's weight may be done by one of two methods: namely, by the wedging up of the launching ways as shown in the figure already referred to, or by the sand-bag method illustrated at the top of page 41.

To understand either of these methods, it is perhaps best first to point out the relations of the launching ways, the stationary ways, and the keel-blocks. The keel-blocks simply support the weight of the vessel while it is being built. The stationary ways run almost the entire length of the ship on both sides of the keel-blocks at points about midway between the keel-block and the sides of the hull, and are constructed of a series of heavy timbers suitably tied together.

These stationary ways are put in place shortly before the vessel is ready to be launched. The tops of the ways are then coated with grease specially prepared to suit the weight of the vessel and the estimated number of days before the launching will take place. The thickness of the layer of grease is also varied to meet



Here are the principal stages in launching a vessel endways. First the weight of the ship is supported by keel-blocks and side shores; then, just before the launching, the stationary ways are put in place and the tops covered with grease; next the launching ways are placed on top of the stationary ways, and wedges and blocks are driven between them and the ship; then the wedges are driven in, lifting the ship from the keel-blocks and transferring its weight to the launching and stationary ways; and—last step except the actual launching—the keel-blocks are knocked out, leaving the vessel ready to slide into the water. Tie-rods keep the launching ways from spreading under the weight

the conditions and the time of the year in which the launching takes place; for it must not melt before the launching date or be forced out when the weight of the vessel has been transferred to the launching ways.

Getting Her Ready to Launch

The launching ways are placed directly above the stationary ways, and are separated from the stationary ways only by the film of grease. The space between the tops of the launching ways and the hull of the ship directly above them is filled in with blocks between which are two wedges, which, when driven up on each other, force the blocks into close contact with the hull. When these wedges on each of the launching ways are driven up far enough, the entire hull is lifted up slightly from an inclination of three sixteenths of an inch to the foot to one quarter of an inch to the foot, and thereby lifted clear of the keel-blocks.

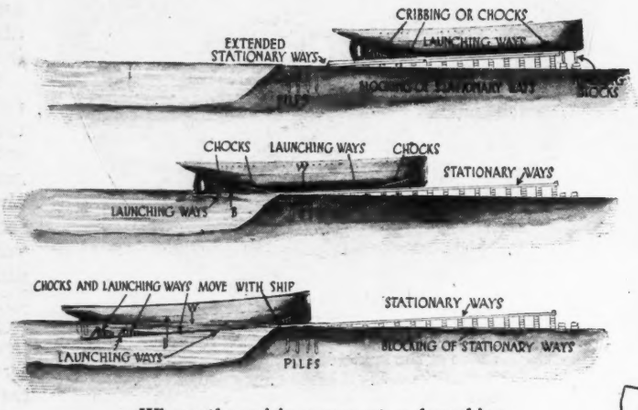
The entire weight of the vessel is at this time supported on the two launching ways, so that the keel-blocks can be removed. The launching ways are prevented from spreading, while the vessel's weight is upon them, by means of steel cables and turnbuckles that join the two ways. The vessel is then ready to be launched.

The Sand-Bag Method

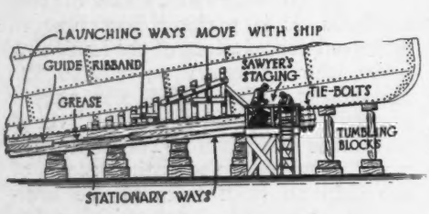
The other method of transferring the weight of the ship from the keel-blocks to the launching ways is by means of sand-bags. The ship is built on the keel-blocks in the usual manner. Before the launching date, the top blocks on alternate keel-blocks are knocked out of place by means of a ram, and bags of sand are placed between the second blocks and the hull of the vessel. Each bag of sand is then wedged up tightly against the hull of the vessel. After bags of sand have been placed on the tops of each of the keel-blocks by this method and the weight is transferred to them, the stationary and launching ways are set up in the manner just outlined. When the weight is to be transferred to the launching ways, the sand-bags are cut, thus allowing the sand to flow out and lower the hull upon the launching ways. The ship is then ready to be launched. The five steps in this operation are clearly shown on page 41.

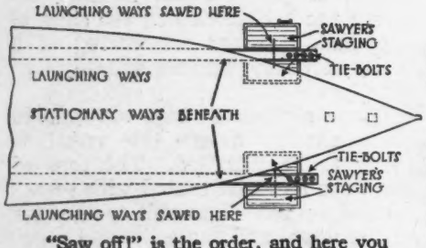
The critical point in the operation occurs just before the vessel becomes entirely water-borne, or supported by the water instead of the launching ways.

At this time the boat tends to pivot about a point near the bow, and it is necessary to build up a wood cribbing at this point to distribute the strains over a larger area of the hull, so as to prevent the keel or bottom plates of the hull (generally narrow at that point) from being crushed in. Similar blocking between the launching ways and the rear portions of the hull is employed.

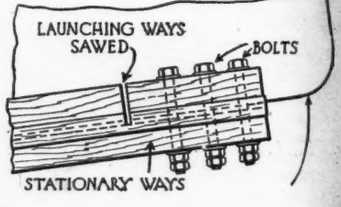


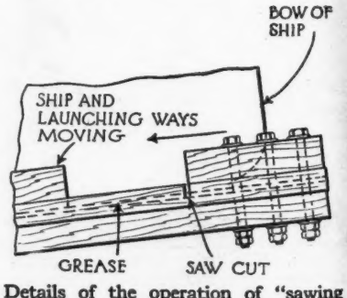
Where the crisis comes at a launching. The upper sketch shows the ship resting on the ways, her weight evenly borne. In the center figure she is partly in the water, her weight acting down at the point W, while at B, the center of buoyancy of the part of the ship afloat, the water is pushing up. The bottom figure shows the moment when, as B and W move together, the boat tends to pivot about a point near the bow and crush the ways or the keel and the bottom plates of the hull



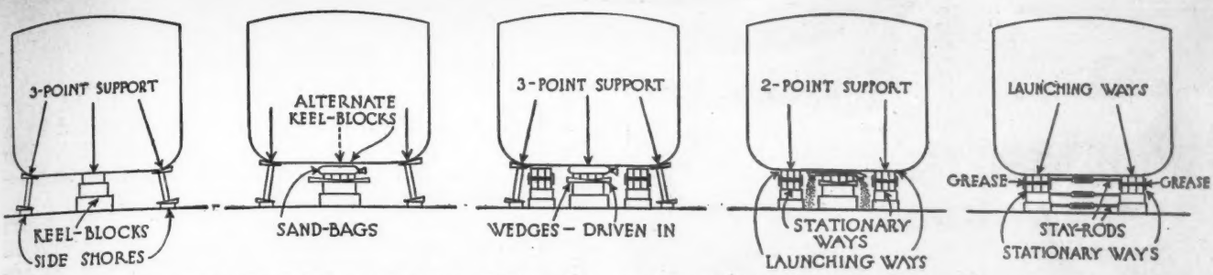


"Saw off!" is the order, and here you can see what is hidden from the ordinary spectator—the details of how the launching ways are cut through to free them from the stationary ways





Details of the operation of "sawing through," showing how the launching and stationary ways are bolted together and how the saw cut sets the ship free to slide into the water



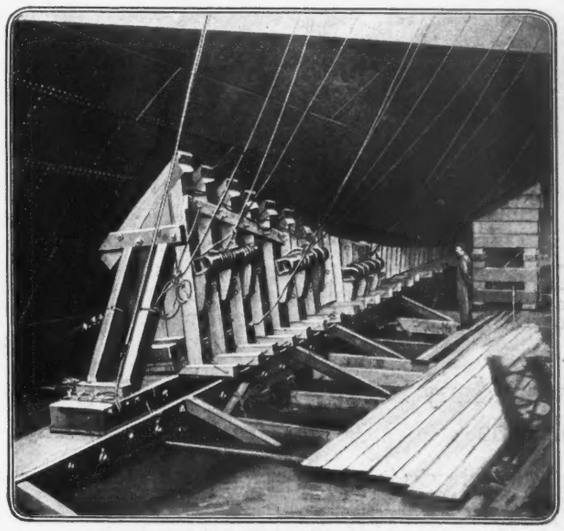
The sand-bag method of launching. Telling the story from left to right, the figures show, first, the ship's weight supported by keel-blocks and side shores; next, alternate keel-blocks are knocked out of place and bags of sand substituted; then the bags are wedged up tightly against the hull. The weight is shifted entirely to the sand-bags, and after the stationary and launching ways are set as shown on the opposite page the bags are cut, allowing the sand to flow out and lower the hull down on to the launching ways. As in the other method, stay- or tie-rods are used to keep the ways from spreading

The next step in the endways launching is the manner in which the launching ways are started to slide on the layer of grease between them and the stationary ways on which they are built. This may be done by the sawing or by the trigger method.

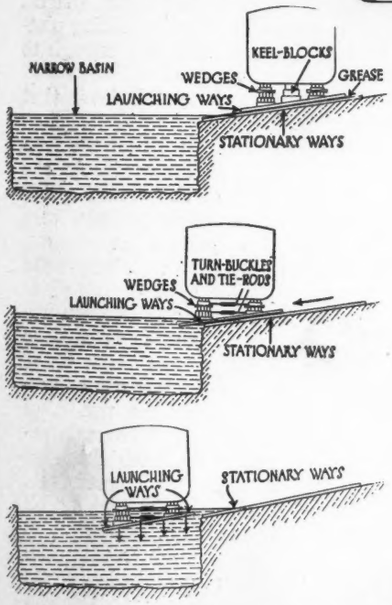
Sawing through the Ways

In the former, the launching ways are securely bolted to the stationary ways at the end farthest from the water. When the vessel is ready to be launched, men with ordinary cross-cut saws mount small platforms especially erected for the purpose and saw through the launching ways. This breaks the connection between the launching ways and the stationary ways.

Great care must be taken in the sawing method to insure that the launching ways on each side are cut through at the same time; otherwise the ship might be given a wrench that would be more than the uncut ways could withstand and lead to their collapse.



A close-up view of a ship resting in her cradle on the ways



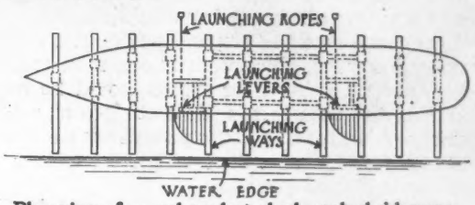
Side launching has the advantage of requiring only a small basin of water. The launching ways are built as in endways launchings. The figures, beginning with the upper one, show the three stages of the operation: the vessel as she rests on the stationary ways, just starting to slide, and all clear of the stationary ways and about to drop into the water

The Trigger Method

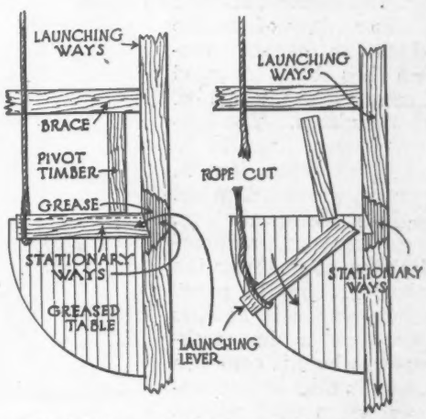
The trigger method is generally considered the more modern, especially for ships of large tonnage. Notches are cut in both the launching and the stationary ways at some point in their length, but not necessarily at the ends, and the triggers are pivoted to the stationary ways. The upper end of each trigger is in contact with a cap inserted in the notch in the launching ways, and holds them fast to the stationary ways. The lower end is fastened to a piston inserted in a small cylinder filled with glycerine and water.

When the boat is ready to be launched, the liquid is allowed to run off both the cylinders simultaneously, thus permitting the pistons to be forced into the cylinders by the tendency of the launching ways to slide on the stationary ways by reason of their inclination. This causes the upper end of the triggers to move around their pivots out of the notches and thus allow the launching ways to move without interference.

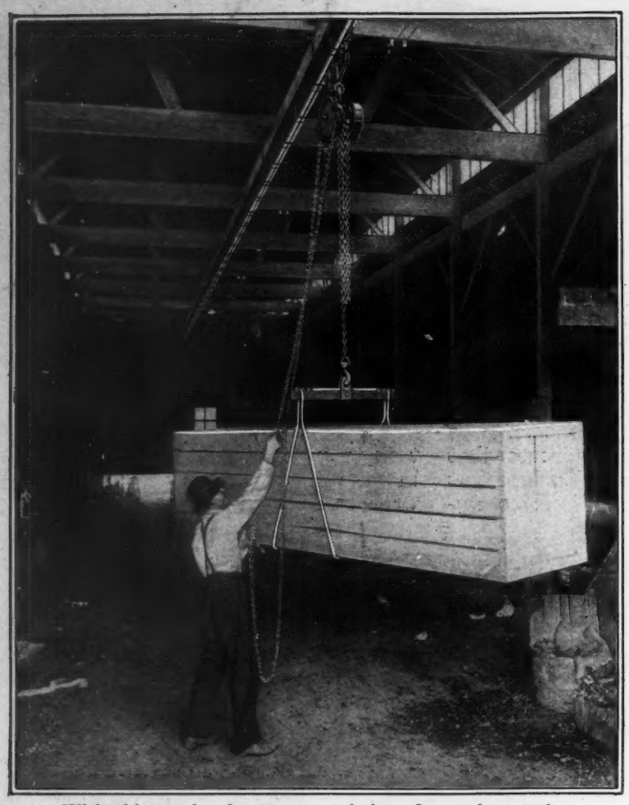
Side launching has the advantage of requiring only a small basin of water. Advocates of this plan claim that there is less strain to the ship in the drop off the ends of the ways into the water than there is in launching a long vessel by the endways method. The steps in a sideways launching are shown clearly. One view gives a plan view of the arrangement of the ways and the position of the launching levers. Another shows the details of launching lever and how it operates.



Plan view of vessel ready to be launched sideways. Note the launching ropes, and see diagram below



At the left the launching lever holds the launching ways in place. At the right the rope has been cut, the pivot timber has fallen, and the ways are free to slide as the levers pull from the notches



With this overhead system, consisting of a track, traveler, and endless-chain hoist, one man and a boy are able to do work for which six men were formerly required

Creating a Sense of Cleanliness in the Hog

THE difficult problem of keeping pigs and mud away from each other has apparently been solved by a southern California ranchman. This man's place, like those of many farmers, has a stream of running water—in this instance an irrigation canal.

He resorted to the simple expedient of building a pen from his hog pasture into the ditch, which was shut off from the field at every other point. This fence he made hog-tight. Then he built a sloping platform of light planks

Yes, pigs do like clean water—when they're allowed to have it

to prevent the formation of a mud-hole and to keep the water on one side of the bank.

Now his hogs are the cleanest live stock on the ranch. Many other farmers are adopting the same method, which works well even in a small creek.

Wheels Overhead Answer Many Shop Trucking Problems

OVERHEAD carriers are replacing floor trucks in many small work-shops as well as in big manufacturing plants. The tracks can be suspended from the ceiling so as to give ready access to all parts of an establishment.

Less cost as well as convenience fight on the side of the overhead system, since with it one man can do work for which several using floor trucks would be required. For instance, the man in the illustration is at work in a large nursery plant, moving boxes packed with trees. The boxes, when ready for shipping, weigh from two hundred to fourteen hundred pounds.

With the overhead track, carrier, and familiar endless-chain hoist one man with a boy helper handles boxes that formerly required six men to move.

The variety of uses to which the overhead system has been adapted illustrates the scope of its usefulness. The system shown here is in successful operation in garages, where it lifts out engines, transmissions, and other parts, and carries them to and from the repair section; in paper plants, where it handles heavy rolls; in stock-rooms, where it comes in handy in distributing material when used with a rolling ladder; and, supported by I-beams, for handling huge steel rolls.

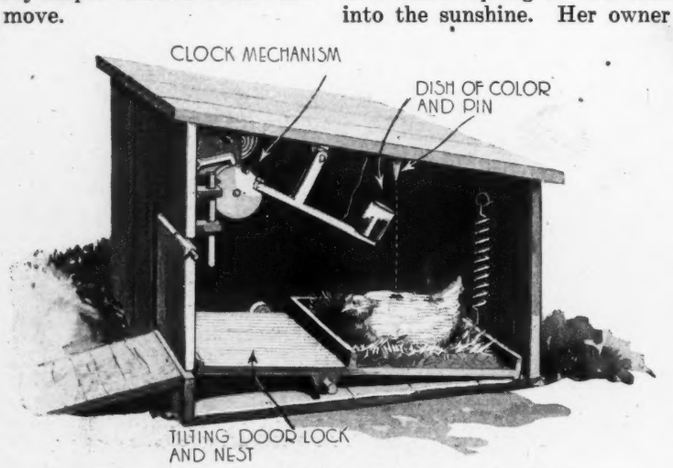
Marking the Dutiful Hen that Lays the Egg

IT must be an astonished hen that enters the nest invented by Ellsworth Tilden of Columbia Falls, Mont. She mounts the nest. It yields slightly beneath her weight. It seems to be on one end of a small seesaw or tilting platform. The other end of the platform rises far enough to block the door and prevent intrusion.

As the hen entered, the door pushed a small lever that started a clockwork device overhead, which was still going. A drop of colored fluid falls and makes a spot on the hen.

She hurries out, leaving behind her an egg. As she starts toward the door, the front end of the seesaw yields slightly under the influence of her own weight and the force of a coiled spring at the back. She pushes her way out into the sunshine. Her owner notes with satisfaction the purple spot on her white plumage. He knows which hen is laying the eggs.

If a farmer owned several hens he would, of course, need several patent nests, each dropping a different colored ink. Unless he bathed all his hens every night he might easily run into this difficulty: a daily layer gets into a red nest today and a blue nest tomorrow. With the blue and red working together, she will register purple—the lawful color of some other hen, thereupon causing a mix-up.



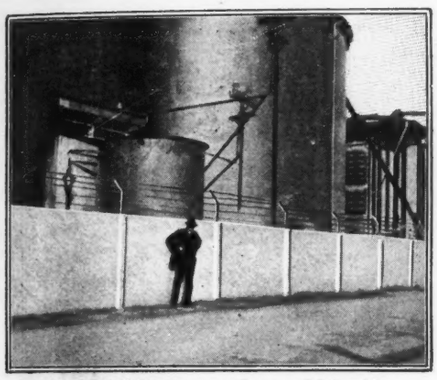
The tilting platform locks the door when the hen is on her nest, and a drop of colored fluid falls on her back

Keeping Oil at Home by Fencing It In

IN the early days, when both oil and natural gas were thought to be as inexhaustible as the ocean, few persons gave a second thought to the sight of a few thousand barrels of oil spouting into the air and running off into a river or sewer. There was always plenty more where the wasted oil originated, so why worry?

Times have changed. We no longer encourage waste even if we know that an exhausted supply can be replenished. That is why a Western oil refinery is surrounded by an oil-tight emergency fence.

If a tank breaks up, the fence gates are closed and the yard becomes an oil lake, the oil being retained long enough to pump it to a place of safety. There are no open sewers within the yard.

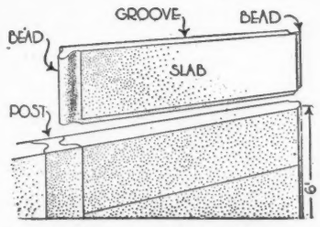


An oil-tight cement fence which will convert the yard into a lake and save oil if a tank should give way

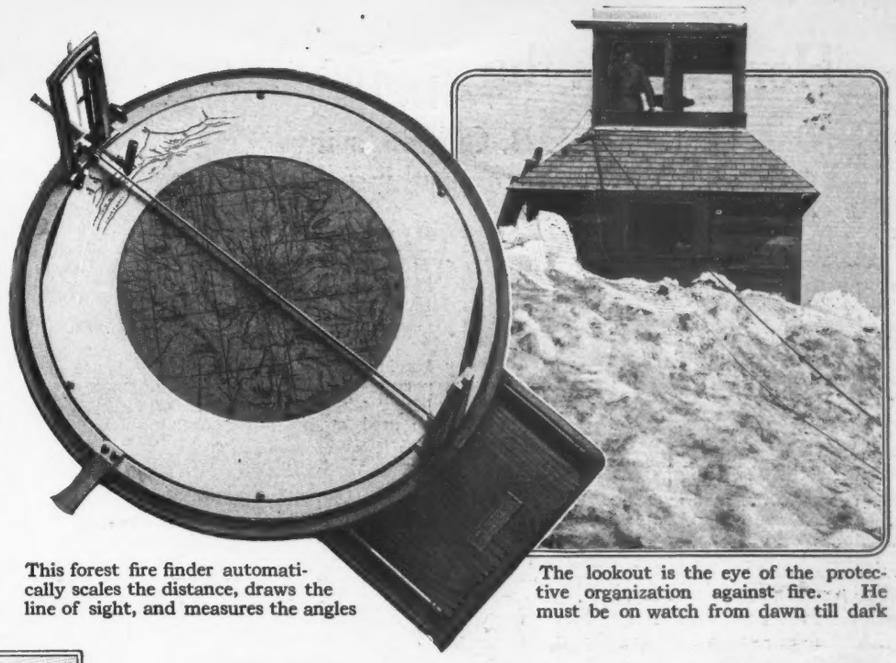
It would be a great oversight to plan a fence of this kind, and then have the oil run through the gutters to the sewer; and yet, just such errors have been made by designers of safety devices and schemes.

The ends of the concrete slabs fit in grooves in the posts, while the sides of the slabs are tongued and grooved so they will fit together in a tight seam. The slabs need not be cemented, and the fence will then be a portable one.

There is no reason why a fence of this type should not be used around any kind of property. Its portability and the simple method of setting up the blocks render it very adaptable.



The slabs are tongued and grooved so as to fit together; not cementing the slabs makes the fence portable



This forest fire finder automatically scales the distance, draws the line of sight, and measures the angles

The lookout is the eye of the protective organization against fire. He must be on watch from dawn till dark

It Spots Forest Fires at Once

WHEN a forest fire is discovered by a lookout, everybody at the station gets busy at once. The volume, character, and drift of the smoke are at once recorded and reported. The direction from the station is read and recorded accurately in degrees and minutes. Even the "angle of depression" is observed.

Prompt action saved much valuable timber last year, and this prompt action was due largely to equally prompt and accurate reporting. An Oregon fire was reported by three separate stations, The newer types of instruments are so constructed that even unskilled observers, or observers of only moderate training, can make extremely accurate observations.

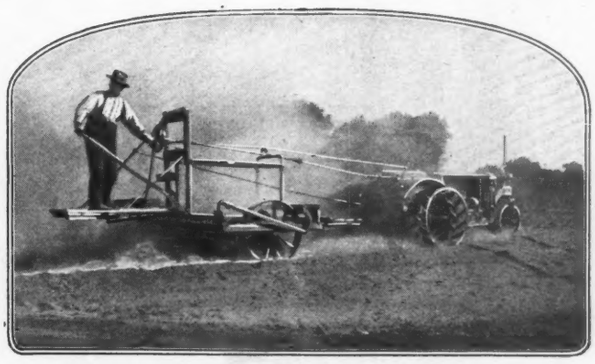
One of the latest types of observing instruments automatically scales the distance on a map, draws the line of sight, measures the angles, and can be moved on a track to a point where the best view of a fire can be obtained, without requiring releveling. Which is "going some."

Make the Tractor Do the Leveling

A BIG job of leveling had to be done at Hanford, Cal., and labor was so scarce that the enterprising contractor connected his tractor with a six-foot scraper, rigged up a platform on the rear of the scraper on which to stand, and then ran extension arms from the tractor controls, so that he could operate the machine from the platform. This did away with the necessity for an extra man.

In leveling for skyscrapers and other high buildings, steam-shovels and scoops of various kinds have been tried from time to time, with varying success. Whether the scraper and the tractor could be used in such undertakings is a question worth looking into.

Digging railroad cuts and other leveling operations along railroad beds might also be performed with the aid of the tractor and the scraper. The cheapest methods are usually adopted in commercial fields, and the present method seems to come up to the requirements.



Labor being scarce, he connected his tractor to a six-foot scraper and did a job of leveling without help

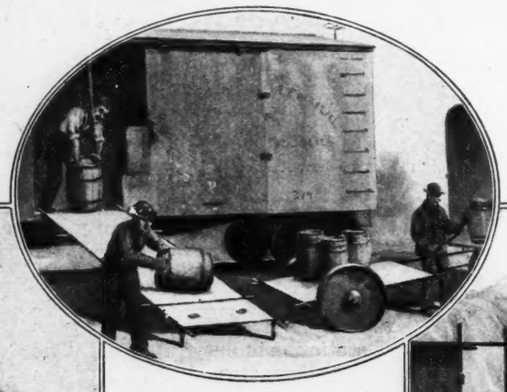
Here It Is—the Magic Wheelbarrow

Major Frank B. Gilbreth's invention, which will do everything but talk

While the wheels of the barrow are serving any one of a dozen purposes, the rods make a fine frame for a tent to house a field telephone set for the surveyor

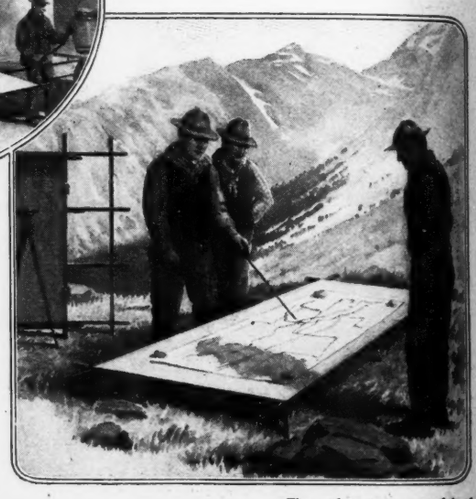
Having helped out in every department of the day's work, Major Gilbreth's invention can be used at night for shelter

This most modern of wheelbarrows not only carries the cement to the building site, but provides a quickly assembled framework for a mixing-board



Should you wish to unload a freight-car away from a platform, just roll up the Gilbreth magic wheelbarrow, and, *presto*, there are both the cart and the inclined plane

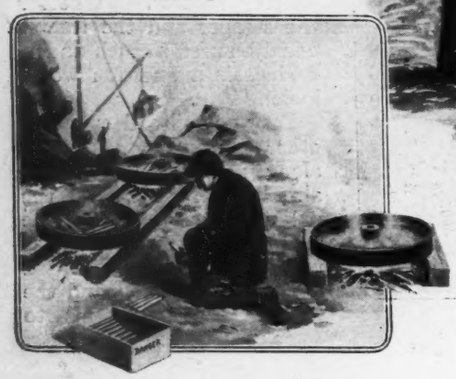
On wheels it carries supplies over the rough logging road to camp, and now, dismantled, it provides the makings of a convenient table

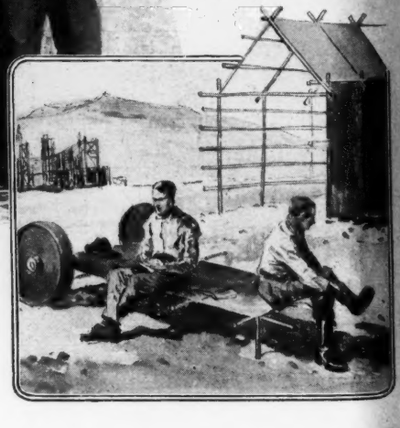


For the topographical surveyor doing field work far from towns the magic barrows become carriers and provide shelter and even an efficient map-board

Rods from the barrows form the framework of a comfortable shack, and the miners use one of the wheelbarrows for a comfortable divan

We've been neglecting the wheels, but here you see how handy they come in for the unexpected use of thawing out dynamite sticks for blasting





Where trail or "tote road" is too rough for wheels, the dismantled barrow still provides a handy means of transporting materials or camp equipment or helping out on a portage

We Discover Peace-Time Uses for the Gas-Mask

Experience has shown that the mask that defied the Hun gas won't always save the fireman who wears it in a cellar fire

Engineers in charge of refrigerating apparatus often face deadly peril from ammonia fumes as they distill coolness for us. Perhaps a gas-mask and an ammonia alarm would solve the "safety first" problem

The deadliest onion loses half its terror when he or she who peels it is properly equipped

There's no military pomp about this job, but the sewer worker knew the gas peril long before the soldier did

Chloride of lime even in barrels gives off chlorine, the gas that first made the word gas infamous on the battlefield

Always carry your gas-mask to restaurants and have it at the "ready": it may save you from a cheese barrage

Perhaps the "whisky breath" hastened prohibition: we suggest the gas-mask as a remedy until July first

Talking Across 34,000,000 Miles to Mars

How can the President congratulate some Martian Republic on the celebration of its Fourth of July?

By A. J. Lorraine

MARCONI, pioneer of radio communication, believes that it is possible to communicate with inhabited planets—if the newspapers report him correctly. Mysterious disturbances are recorded by sensitive radio receivers. Are messages coming from Martians frantically trying to communicate with us? Perhaps. At any rate, Marconi predicts the possibility of sending out electric waves to the planets. And if a great radio engineer believes in communication between worlds the matter is not to be lightly dismissed.

It is older than radio-telegraphy, this idea of talking to the stars. Before Marconi sent his first wireless message, it was suggested that we might flash signals into space or draw geometric designs on large surfaces in electric lights. Flammarion, Schiaparelli, Lowell, all of whom passed a life-time in studying Mars, have sponsored the scheme.

How Much Power Would It Take?

Now, the electromagnetic waves used in radio-telegraphy have this advantage over light waves: Atmospheric dust and clouds, both of which obscure light, offer no obstacles to the long waves that Marconi uses. What about the electric eyes, the receivers, that see these radio waves? The human eye is probably more sensitive—about ten times as sensitive, according to recent measurements. But the receiving area exposed to the incoming waves can be adjusted within wide limits, unlike the pupil of the eye, the size of which is fixed by nature.

Suppose, then, we try to send a radio signal to Mars. How much power would it take?

We ask the engineers who designed the radio stations used on the earth. About 400 kilowatts (540 horsepower) are required, they tell us, to communicate under normal conditions over 4,000 miles. Greater ranges are obtained when the conditions are favorable.

It looks black for wireless telegraphy. Still, Mr. Marconi may have reason for optimism. He may see possibilities in the use of directed waves, possibilities that are not obvious to others not so well informed.

Perhaps we shall have to fall back on light, after all. We shall have to establish a code based on the use of electric lamps or searchlights. But how?

One suggestion is that we should make a huge diagram in some cloudless part of the earth of a well known theorem in geometry. "The square on the hypothenuse of a right-angled triangle is equal to the sum of the squares on the other two sides."

That might be a good one to begin with. Every school-boy knows it; an educated Martian ought to recognize the diagram at once. To show that they understood, the Martians might reply by drawing in light some equally well known Euclidean proposition. Picture would follow picture, until at last perhaps some kind of a code would be established. Or, more simply perhaps, something like the Morse system could be applied to flash signals of long and short duration.

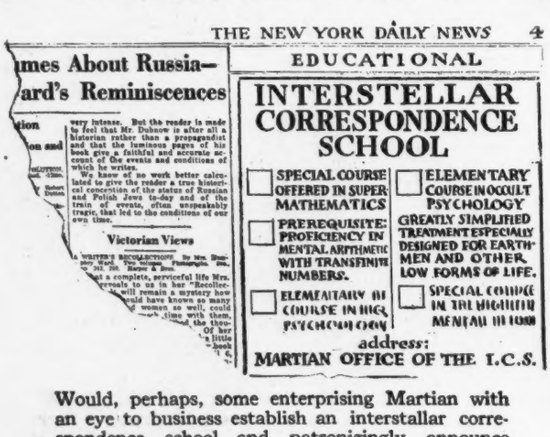
What can be seen on Mars? More than you probably suspect. A circular or round spot fifty miles in diameter can be distinguished with a good telescope under favorable conditions—a spot, for example, as big as London.

A dark line three quarters of a mile in width would also be visible. Bright points of light at night, or a line of lights, might be seen, even if narrower than three quarters of a mile. Searchlights have been made for which a brilliancy three times greater than that of an ordinary carbon electric arc lamp is claimed. They are about two thirds as bright as the sun. One of these installations is described as having a total of 1,200,000,000 candle-power. How blindingly dazzling it must be! How far into space it must penetrate! Yes; but Mars at its nearest is 34,000,000 miles away.

Talking by Light Flashes

Talking to Mars by flashes or by lines of light would at best be expensive. Generally speaking, only about two or three per cent of the energy that drives the dynamo by which the light is produced appears in the form of visible radiations. Seven per cent, it is true, is claimed for the mercury vapor lamp and the flaming arc. But how pitifully small is even that seven per cent! Again, the eye, marvelous though it may be, has its limitations.

It is true that even without a telescope you could, in absolute darkness, see a light of one candle-power at a distance of sixteen miles, according to some recent and very accurate measurements that have been made—but only just see it and no more. If energy thus received could be utilized to heat a pound of water, it would require about 267,000,000,000 years to raise its temperature one degree Fahrenheit. But this extreme sensitiveness is needed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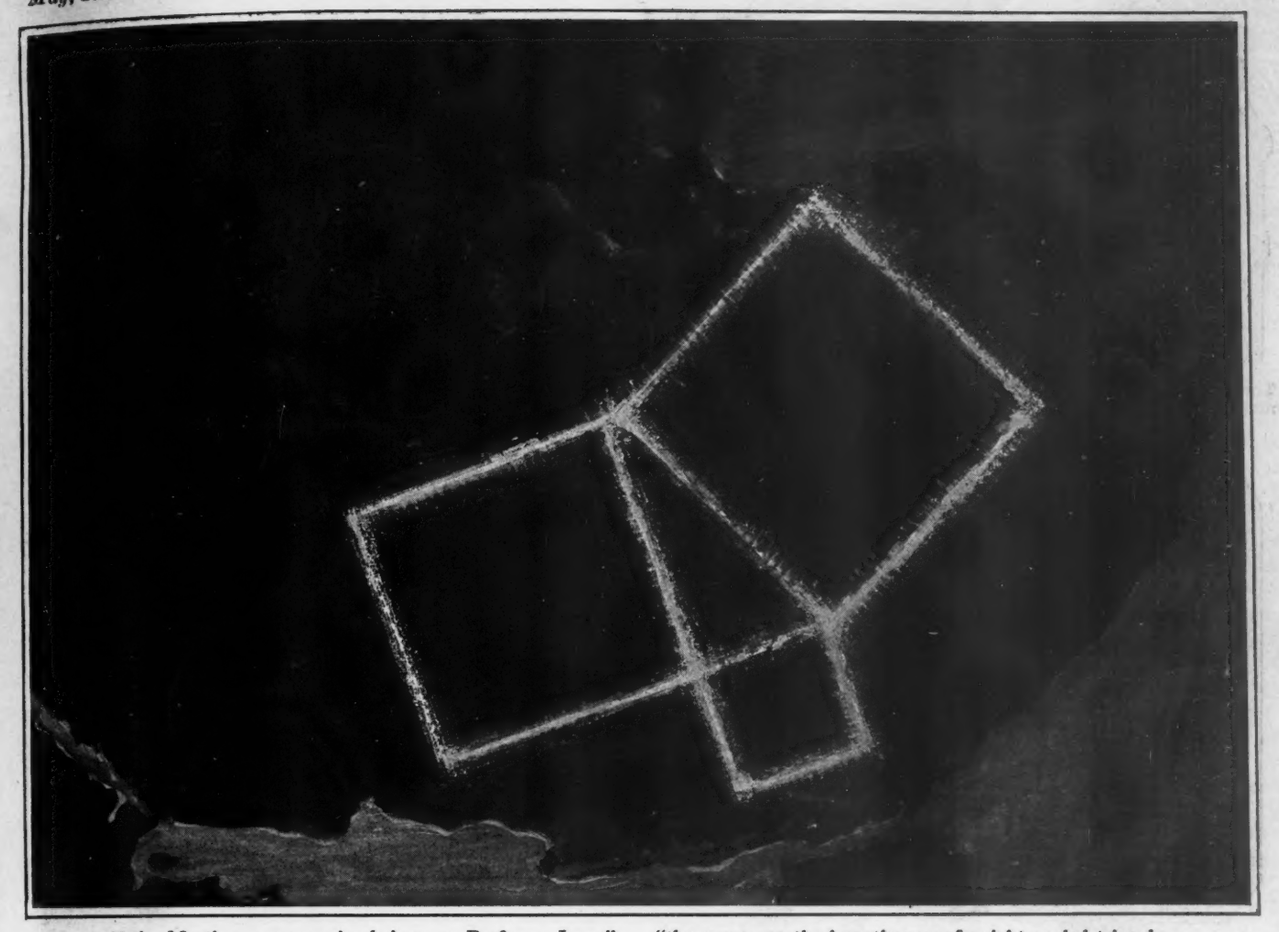
Would, perhaps, some enterprising Martian with an eye to business establish an interstellar correspondence school, and patronizingly announce "Elementary Courses" in mysterious subjects for Earthmen and other undeveloped intellects?



If the Martians are superior beings, as Professor Lowell has argued, what shall we say to them? Something simple, something fundamental, to begin with. Thus we might present to them in electric lights strung in the desert of Sahara, as we have shown here, the proposition that "the square on the hypothenuse of a right-angled triangle equals the sum of the squares on the other two sides." The Martians ought to recognize that Euclidian theorem, and reply with another. Picture would follow picture, until at last some kind of interstellar code would be established

because the eye has very serious limitations in another way: The pupil, even when widely dilated, measures only about one tenth of a square inch in area. It therefore catches only a very small part of the light sent out by a distant object. A telescope helps, for it is a light-gatherer.

But suppose that we could send signals of some kind to Mars. What about the Martians? How could we make them understand? Lowell tells us that Mars is very much older than the earth. Therefore, one might reason, the Martians have had time to evolve into creatures intellectually far superior to ourselves.

The Superior Martians

How can we talk to this superior being? Difficult as it would be to establish a basis of common understanding, the obstacles are not insuperable. Helen Keller, blind, deaf, and dumb, has learned how to communicate with her fellow beings. How do we know whether a Martian has eyes? We do not know. But, at least, we can make some deductions based on what we know about nature.

The human organism is not a mere accident. It is the result of a definite set of circumstances. The sun sends out light: so we have developed eyes to see. Sounds are transmitted by the atmosphere: therefore we have ears to hear. Heat is sent to us by the sun: we are equipped to feel it. All this applies to innumerable species of animals. So, too, are ears common to many creatures.

The conditions on Mars are different from the conditions on the earth. But it receives light and heat from the sun, just as we do. Therefore the Martians, we may well suppose, are able to see light and to feel heat. Mars has an atmosphere that carries sound; therefore the Martians have ears. In other words, if under the conditions described many kinds of creatures on the earth have developed eyes, ears, and other senses, it is reasonable to conclude that the Martians have developed senses like ours if their planetary conditions are similar enough to ours.

Now, if the Martians are superior beings, as Lowell has argued, what shall we say to them? In the beginning, something simple, something fundamental. By way of casual conversation, let us flash to Mars the news that twice two is four. Irrelevant, you say? Not nearly so irrelevant as saying "How do you do?" to a friend on the street who is obviously doing very well. The mere fact that we of the earth have actually bridged the immense chasm that separates us from Mars ought to produce an effect so dramatic that the Martians would condescend to speak to us. Perhaps they would regard us with mingled curiosity and patronizing kindness, as if we were rather clever children.

What Would They Tell Us?

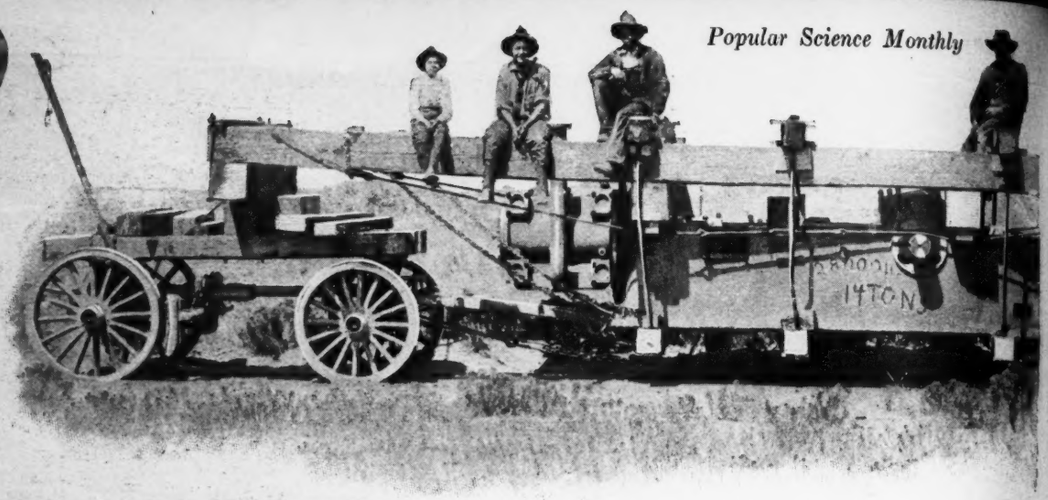
What would the Martians have to tell us? Their world is dying—dying for lack of water, Lowell tells us. Would they paint terrible pictures of the tragic end that is in store for them?

Or would they furnish us with thrilling descriptions of their marvelous achievements in science?

Would, perhaps, some enterprising Martian establish an Inter-Stellar Correspondence School for "Earthmen and other undeveloped intellects"?

Who knows? At any rate, if it amuses you, you may speculate about it.

This carburetor automatically adjusts itself

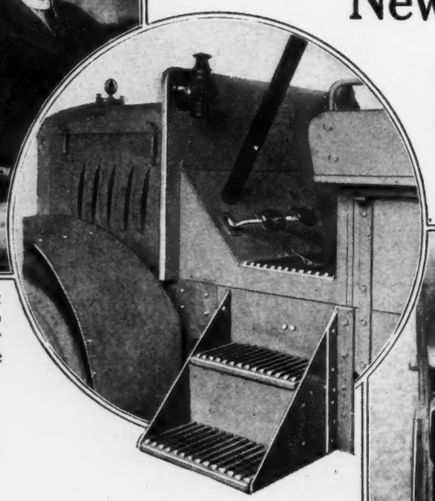


This truck went out of its way to carry a fourteen-ton engine-attempted by anything other than a railroad flat-car and teams

New Inventions for

Proving that peace-time back into their own after

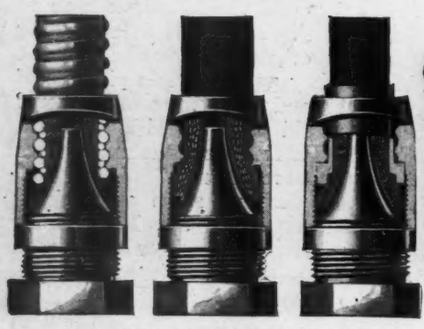
No, she isn't making up, but saying "Home, James," to the chauffeur through her camouflaged telephone



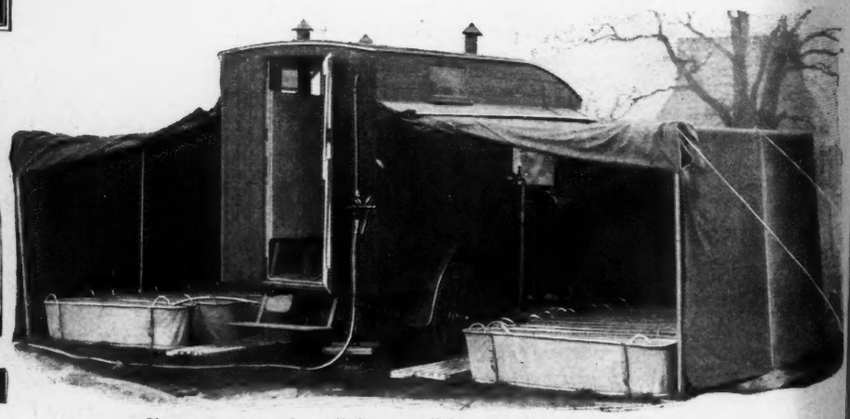
For the driver's convenience the modern motor-truck has a two-step running-board with wooden treads to prevent slipping

Press the brake-pedal and this stop signal works automatically as long as the brake is down

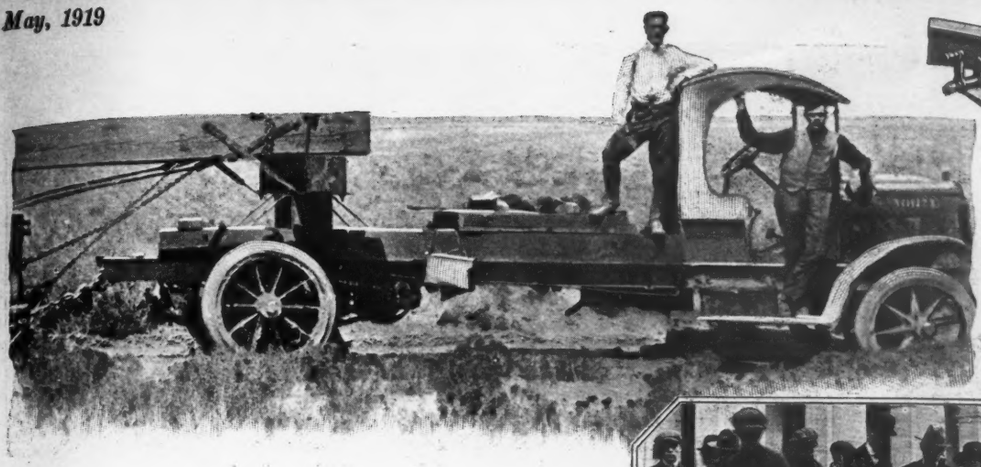
Originally built to meet severe army service, this electric valve-grinder seats a new valve in from six to ten seconds

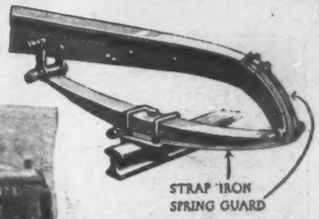


A new coupling with a cone nozzle fits any 5/16- to ¾-inch plain or armored hose



Forerunner to clean living conditions on the road is this portable bath-house with collapsible tubs and hot running water





The straps prevent the end of the axle from moving backward, preserving steering control in case of spring breakage

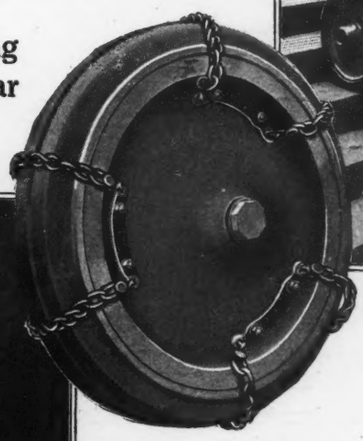
bed over Wyoming's rugged topography, a stunt never before utilizing twenty-four horses. Of course, the truck won its venture

the Automobile Driver

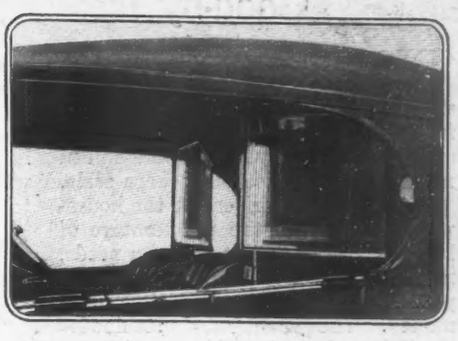
accessories are coming lying dormant during war

An efficient worker is this porch-climbing truck designed for freight terminal work; it turns around in a ten-foot circle

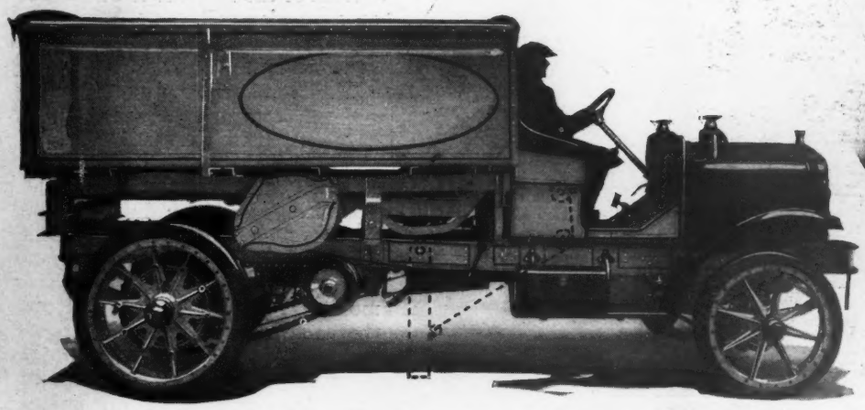
J. F. Conder's automobile signal, with ruby and green lights, an arrow designating the direction



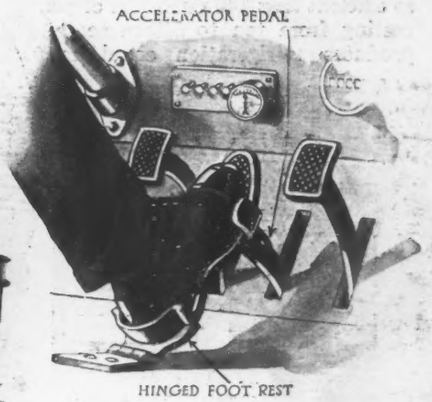
Machines equipped with disk wheels can now use skid-chains with this attachment



The wind-shield consists simply of two wings attached to the back of the front seats, which are adjustable to any position



A simple load meter entails a stick which touches the ground when the maximum load is installed, being sprung up out of the way when the truck is running



A comfortable foot-rest for the accelerator that relieves leg strain and the "wabble" so detrimental to gas economy

The patients are made as comfortable as possible on their trip, lying down or sitting up as they feel inclined

Clean, neat, and comfortable is this car, ready for its brain-sick passengers

The Lunacy Limited

THE Cook County department of public service of Illinois has built the first special car for the traveling insane, in order to shield them from contact with a curious public.

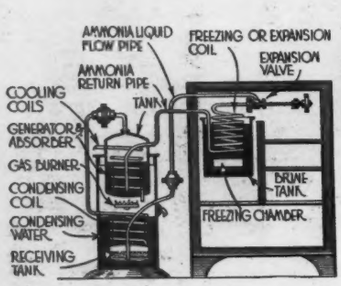
The car, which has its own motive power for electric lines, is provided with all the latest comforts and conveniences. There are berths for those who wish to lie down. The shades are usually drawn, so that patients will not be excited by street sights. A nurse is in constant attendance.

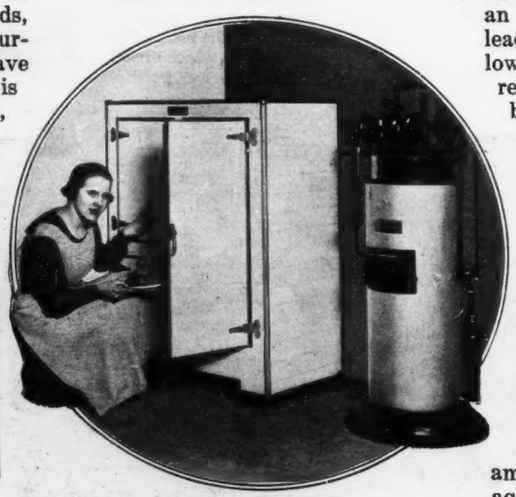
They board the car in an out-of-the-way place where there are not likely to be passers-by

Good-by Iceman; Here's an Automatic Refrigerator

THE gas refrigerator, entirely automatic in its operation, promises to work a revolution in household refrigeration systems greater than any since machines were first successful in making artificial ice on a large scale.

With the gas refrigerator the housewife can regulate the temperature of her refrigerator to suit her own needs, make enough ice for household purposes, and at the same time save money. The gas-operated machine is so efficient that 140 cubic feet of gas, costing from ten to fifteen cents, produces refrigeration equal to that from a hundred pounds of ice. The gas-operated refrigerator works on the same principle as the large refrigerators and ice factories; that is, liquid ammonia is turned into a gas, which expands, taking up enough heat to cool the pipes through which it passes. In this new machine, however, the whole operation is reduced to a small scale, with the result that the domestic size machine in twenty-four hours gives refrigeration equivalent to the consumption of 150 pounds of ice.





As in ice factories, liquid ammonia is turned into a gas, which expands, cooling the pipes. There is no mechanism to get out of order, no moving parts or whirring wheels

The machine consists of a tank called the generator, which contains an aqua-ammonia solution. A pipe leads to a coil in the condenser; the lower end of this coil is connected to a receiver. Another pipe leads from the bottom of the receiver to one end of an expansion coil.

Heat is applied to the bottom of the generator from a gas-burner. This heat releases ammonia gas from the aqua-ammonia solution. The gas passes into a water-cooled chamber in the upper end of the condenser, and is discharged in a liquid condition. The liquid ammonia under pressure then passes into the expansion coil, where evaporation of ammonia gas from the liquid performs the cooling function. The spent ammonia gas passes back into the aqua-ammonia solution and is used again. The only attention needed is the lighting and extinction of the gas.

It's Off—the Airplane Freight!

The engineer of the fast air freight is at his post and ready to start. He's an old-timer, and the run from Folkestone in the very southeast corner of England to Ghent in Belgium—about 100 miles in an air line—is an easy one

At the air-ship freight-sheds. Packing must be done compactly for the flying freight. Some day we'll be contrasting these pictures with the giant freight-plane passing along the air lanes, much as now we contrast pictures of the early steam trains with the Twentieth Century. Not long ago a New York department store made suburban deliveries by airplane, trying out as an advertising "stunt" what may become an unnoticed daily incident

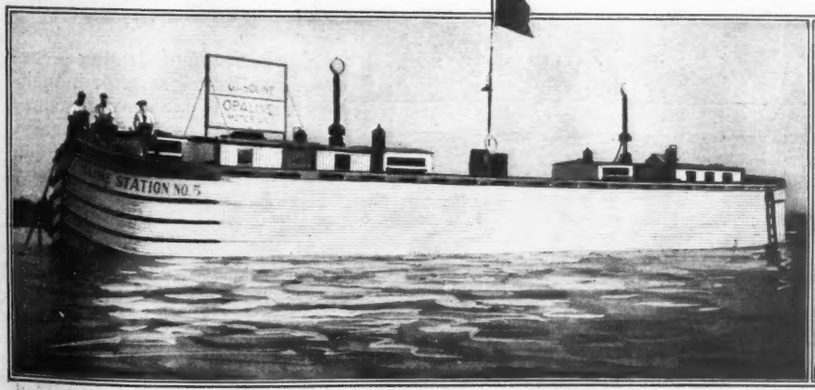
Loading the airplane freight. Will the workers be known as the 'longskymen's union?

Here's a Floating Garage for Motor-Boats

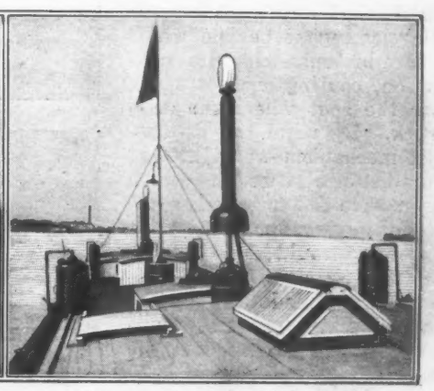
OUT in the Detroit River is a floating garage for motor-boats. Are you out of "gas"? Head for "Marine Station No. 5" and you can buy what you want, just as you buy it on shore.

The regulation type of pump is on deck, while a hose of sufficient length is at hand to supply all comers. The oil-barge is an old one especially refitted for the purpose. The equipment includes four 3,500-gallon gasoline-tanks, three 1,000-gallon oil-tanks, and one 1,000-gallon kerosene-tank.

The supply station is open and doing business twenty-four hours in the day, never leaving its anchorage unless navigation is closed.



A gasoline service station anchored in the Detroit River; it carries 14,000 gallons of gas and 3,000 gallons of oil



Every appliance for the convenience of motor-boats is found on board

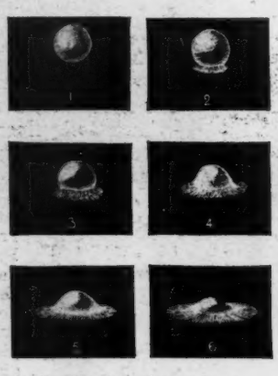
The Story of a Splash

What happens when the drop falls in the bucket

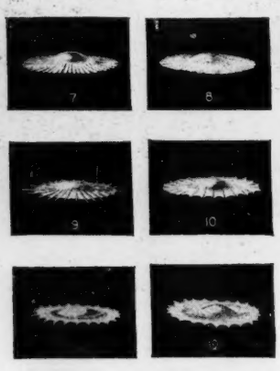
By H. E. Howe

"JUST a drop in the bucket" is a familiar and useful simile, but it remained for an English schoolboy to wonder what happens when the drop strikes in the bucket. He tried to find out by causing drops to fall upon carefully smoked glass, after which he could study the prints made by the drop upon the carbon. Some twenty years later Professor A. M. Worthington became interested in drops, and in 1894, under the title "The Splash of a Drop," delivered an address setting forth his observations. This was afterward printed by the Royal Institution.

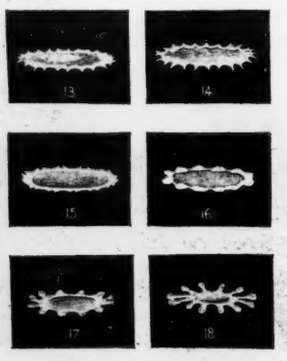
It was certain that any changes that a drop undergoes must be of exceedingly short duration. Hence the first problem, as in most investigations, was that involved in providing suitable apparatus. A drop of definite size was to be allowed to fall from a definite height in darkness, and any desired stage in the phenomenon illuminated by a spark of such exceedingly short duration that all other stages would remain unobserved and not blur the picture.



Surface tension causes the gymnastic exercises that a drop goes through when it falls



As the drop spreads it forms distinct rays—sometimes as many as twenty-four (Fig. 9)



Forming pairs of lobes. Fig. 17, with twelve pairs, is the climax of this stage

Many Observations Necessary

These conditions were eventually satisfied by providing two similar levers released simultaneously by an electromagnet. From one lever the drop was allowed to fall from a small watch glass smoked to prevent wetting, and the other let fall a marble that struck an adjustable releasing mechanism, which in turn broke an electrical connection, causing a short spark near the spot where the drop struck. By regulating the release mechanism, and therefore the distance through which the marble fell, intervals separated by very small fractions of a second could be secured.

At the time the first experiments were made the photographic plate was not sufficiently rapid to record the image, so that Professor Worthington found it necessary to make a very large number of observations of each stage until he could accurately sketch what he had seen. Later on he had the satisfaction of being able to confirm his early work, using more modern photographic apparatus and fast emulsions.

The illustrations reproduced here are from a series of drawings, and illustrate the exercise a drop of mercury takes when one .15 inch in diameter falls three inches upon a smooth glass plate.

Time, One Twentieth of a Second

Surface tension is responsible for the movements and patterns observed. The distinct rays shown in number nine are twenty-four in number, as determined by counting the droplets that squeeze off the end of these rays. Next, an annulus with a very thin area between center and rim is formed, followed by the rim forming pairs of lobes. These are drawn together until in stage seventeen we find twelve lobes.

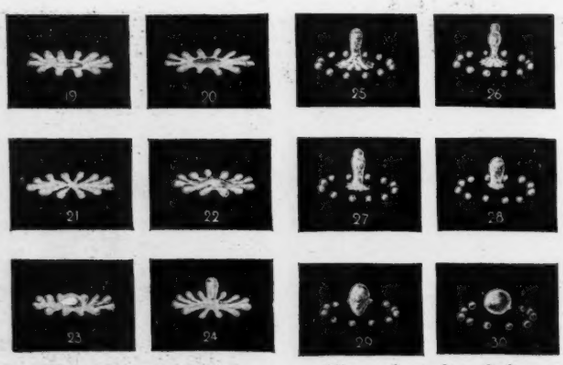
Surface tension checks the spread, and then a rapid and powerful contraction takes place, causing the mercury to rise in the center almost to the breaking-point, as in twenty-six. This sudden drawing in of the lobes causes droplets to become detached and marks the beginning of the rebound. At the end we may have two circles of different-sized drops surrounding the remainder of the original drop, and the entire series of thirty stages takes place in a total time of about one twentieth of a second—an interval of one six hundredth of a second for each stage.

At certain stages, such as numbers fourteen, fifteen, and sixteen, the mercury is sometimes covered with beautiful concentric rings.

The phenomenon depends upon four factors:

1. The size of the drop.
2. The height of the fall.
3. The surface tension of the liquid in question.
4. The viscosity of the liquid.

The possibilities of this interesting study have by no means become exhausted. Study drops of ink or of milk falling upon water, or indeed the phenomenon of large drops of water falling upon water, giving rise to the beautiful bubbles so often seen in a hard rain. Solids falling into liquids are another possibility.



The surface tension checks the spread of the drop and causes the center to rise

The rebound. Only one twentieth of a second intervened between Figs. 1 and 30

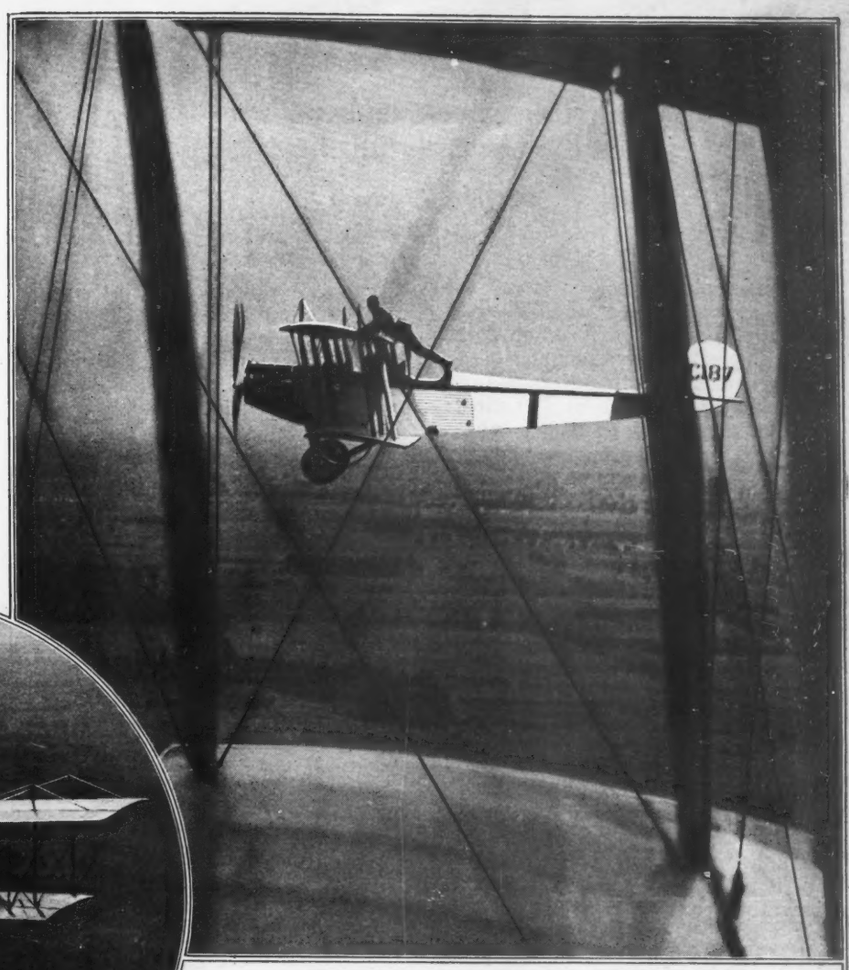
Value of Modern Photography

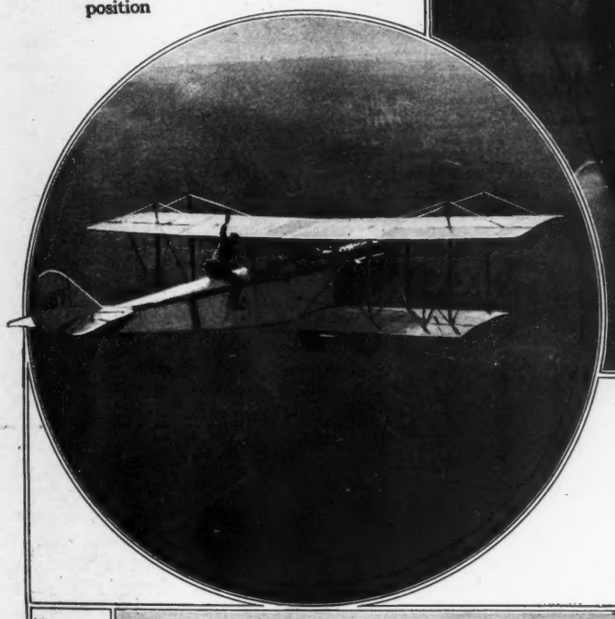
Modern photography — remember that Professor Worthington did his work before 1894—ought to record unusual features. He used a Leyden jar spark for his photography, the duration of such a spark being probably less than ten millionths of a second.

It would be interesting to determine whether our more recent methods are any more satisfactory, so far as results are concerned, than the careful work of a patient trained observer.

Here's a Bare-Back Rider of the Air

Lieutenant Ballough fears the bucking airplane as little as a broncho-buster does a "bad" horse. But then, airplanes don't really buck any more. Modern flying-machines always right themselves if they are high enough. Only on an inherently stable machine is Lieutenant Ballough's feat possible. Of course, the Lieutenant took good care that he did not throw the center of gravity from its correct position





Although the Lieutenant takes many liberties with his airplane, he has to keep close to the machine's center of gravity. If he were to venture too far from that center, all balance would be destroyed and something would happen quickly

If he steps off it's two thousand feet down; but he has learned to trust the stability of his machine. He can step out on a wing (not very far, to be sure) and walk forward and backward—something that was entirely unthinkable ten years ago

Pictures © Keystone View Co

Flying a Mile High, He Hears You Speak

How the radio-telephone now links the airman with the earth

By John Vincent

The manufacture of a suitable helmet was only less difficult than the production of a good transmitter

WHEN a swift-flying V of eleven monoplanes soared into the view of Colonels Reber and Culver at the 1910 Belmont Park Aviation Tournament, the same thought, oddly enough, came into both their minds and was expressed by Colonel Culver:

"What a splendid thing it would be in battle if those eleven planes could be instantly commanded by their leading pilot! What could be done with the control of every evolution from the air or from the ground, and with each pilot receiving instructions from moment to moment!"

It is easy even for civilians to see what this would mean. Directions given before the flights began, as conditions changed with the suddenness of war-time needs, could be changed, and each flier could be told just what to do in a mass attack on the enemy. As the two colonels looked back to the wireless telegraph work that had already made it possible for pilots to report observations to ground stations miles away, they determined that this ideal of a voice-commanded squadron of airplanes should be realized.

How the complete radio-telephone transmitter looks on an airplane assembled ready for installation

What Has Happened Since

In five years the telegraphic branch had been developed to a point at which airplane communication was demonstrated over one hundred and forty miles at the flying school near San Diego. In another year it was possible to telegraph in both directions between airplanes in flight, without serious interference from the noises of wind and motor exhaust.

Early in 1917 the wireless telephone was used to talk from the air to the ground, and in October of that year experimental radiophone outfits for squadron flying were taken to France for demonstration by Colonel Culver.

A year later Major-General William L. Kenly and Director John D. Ryan, in charge of the air program of the nation, announced that the voice-commanded squadron was a reality, and that, since the signing of the armistice had removed the need of secrecy, its effectiveness could be shown to the public.

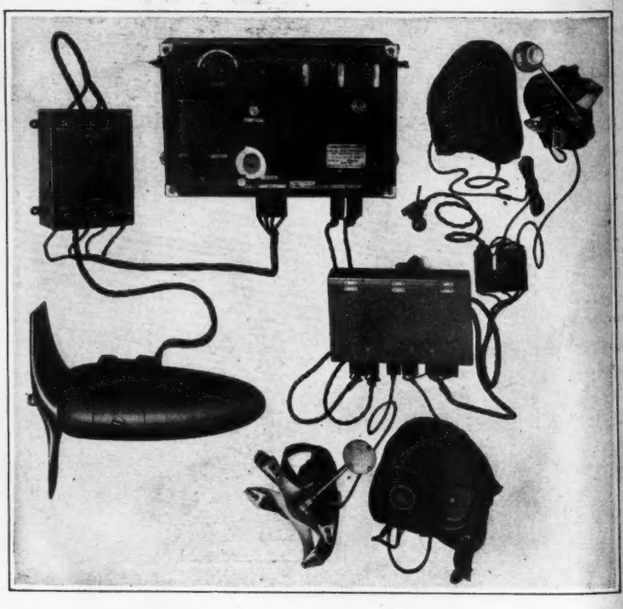
Demonstrations in Washington, at which President Wilson and Secretary Baker were present, banished the last doubts as to what had seemed an impossible dream only six years before.

At one of these demonstrations the President, standing on the White House lawn, gave a command to dive. Immediately a swift de Haviland, flying overhead, nosed toward the earth at increased speed until, at the words "Flatten out," it turned into the horizontal and sped on in a great curve to obey the further instructions from the ground.

How can such a thing be done? How can the ear-pieces strapped to each aviator's head, sheltered from the outside roar of motor and wind by a padded helmet, reproduce the very words spoken by the flight commander, whether he be seated in another airplane or at a distant point on the ground? It seems a marvelous thing, but is it really more wonderful than the act of sending a telephonic message by wire from New York to San Francisco?

Magic of Wire Telephony

In wire-line telephony we know that the vibratory sound-waves of the voice strike against the diaphragm of a transmitter, causing this diaphragm to vibrate in a similar way. The mechanical vibrations compress and release a capsule of carbon granules fastened immediately behind the diaphragm, and the variations in pressure create variations in the resistance, which the granules oppose to the flow of an electric current through them. The intensity of the constant stream



Here is the complete radio-telephone equipment for a "two-place" airplane. The head-pieces and speaking sets are easily picked out. From them wires lead to a switch-box. By turning a knob on this box the observer or pilot can cut out the outside world and talk with each other. From the switch-box the wires run into the large box at the top of the picture, which houses the transmitting and receiving sets. The small box at the left is a "filter," which eliminates the noises that are caused by the wind-driven generator shown below it

of current generated by a battery or dynamo, and passing through the granules, is thus varied in accordance with the voice vibrations. This fluctuating current is led along the line wires from the transmitter to the distant station, and there is applied to a telephone receiver.

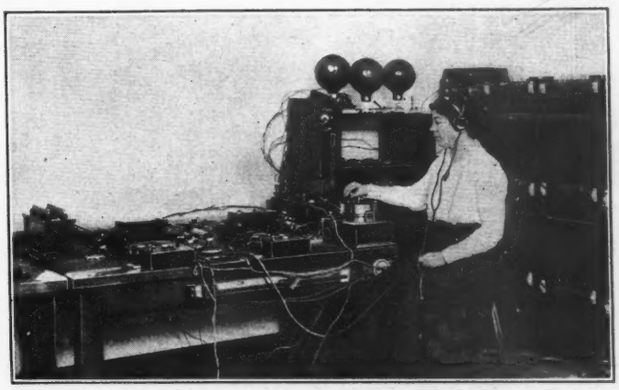
The receiver contains a diaphragm which is moved magnetically by the incoming currents, and which vibrates at a speed and intensity governed by the variations in the currents. Since these current-vibrations are similar to those of the voice at the transmitter, the receiver-diaphragm vibrations that they produce are also similar. Consequently the receiver recreates sound-waves similar to those generated by the voice at the sending station, and the listener hears a reproduction of the words as they are spoken into the transmitter. Although a number of simultaneous operations are involved, the action is evidently not at all complicated.

Analogous to Wire Transmission

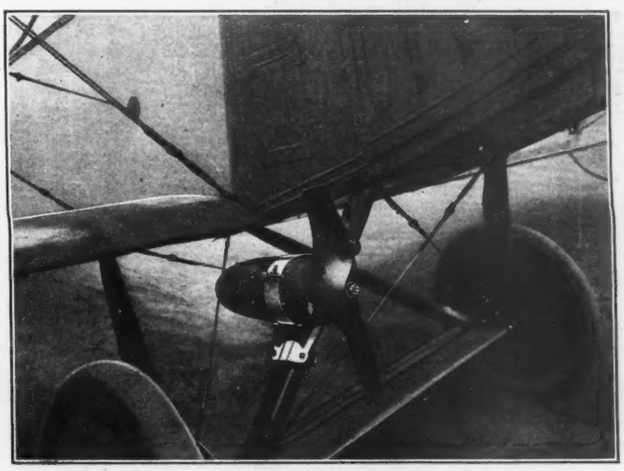
For transmitting the voice by wireless an entirely analogous set of conditions exists. The main and obvious difference is that there are line-wires to conduct the continuous stream of voice-carrying electric current from the transmitter to the receiver. Some other way of conveying the voice-controlled vibrations must therefore be found; and in radio-telephony this part of the communication system is based upon the properties of electromagnetic waves in the so-called ether of space. Just as a candle radiates light-waves in all directions, so a suitable radio-generator will radiate streams of electromagnetic waves to distant receivers in any direction. Having at hand such effective carrier-waves to transport signals from point to point through the air, whether on the earth's surface or above it, all that remains in order to transmit speech by wireless is to devise suitable apparatus for the sending and receiving stations.

The wireless transmitter, like that of the wire telephone, contains a diaphragm and a capsule of carbon granules. However, instead of merely varying the intensity of a stream of current passing out over wires to the receiver, the radio-transmitter varies the strength of a continuous stream of electromagnetic waves, these being radiated into space in all directions from an aerial wire.

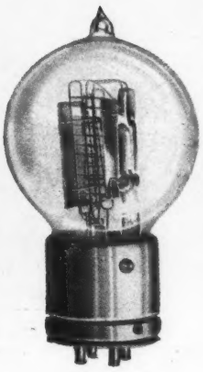
A portion of these waves necessarily reaches the distant receiver, and there is caught by a similar aerial wire in which the waves induce high-frequency varying currents. These currents are then led to the receiving apparatus, by which they are first converted and magnified, and then applied to a telephone instrument in which they reproduce the sounds spoken.



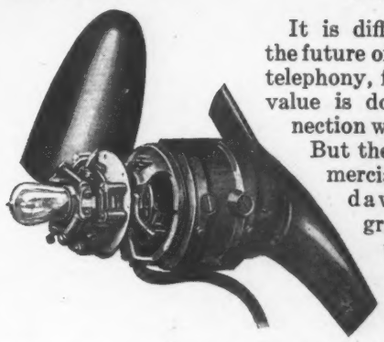
Testing the vacuum tubes or bulbs of the instruments which detect electromagnetic oscillations coming from any radio station, amplifying them so they can be heard



The bomblike object is a double-voltage generator; it is driven by the propeller at its forward end, the propeller acting much as does a child's pin-wheel



This amplifier, with its high vacuum tube, increases the sound of the signals from five to ten times



When the cap is removed you get a glimpse of the mechanism of the wind-driven generator, showing the voltage-regulating tube

Imagine a fleet of airplanes in which each is equipped with a complete radio-telephone transmitter and receiver. The pilot of the commanding airship can control his squadron instantaneously by his spoken orders; the group can act in unison for attack or defence, and movements of enemy airplanes or forces detected by any observer can be immediately described to all the others.

Some of the Difficulties Overcome

The manufacture of a suitable helmet that would exclude the terrific explosions of the 400-horsepower Liberty motors (which are invariably used without muffling-chambers) was only less difficult than the production of a good transmitter.

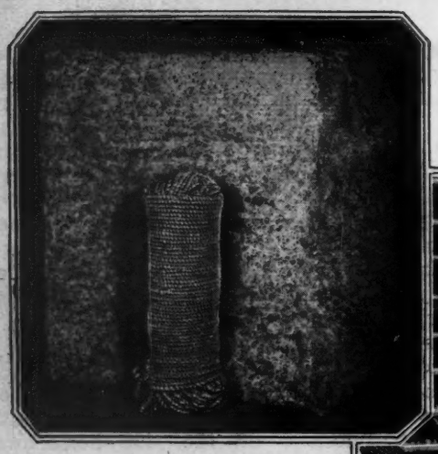
When one considers how the ordinary telephone picks up the noises of passing trolley cars or trucks, it is easy to appreciate the amount of work that was required to make a microphone which was marvelously sensitive to the human voice and yet scarcely affected by the thunder of the motors or the rushing of the wind.

Another knotty problem was the arrangement of the aerial wires so that they would not trail far behind the airplane and become entangled when loops or dives were performed, or when the other airplanes of the flying squadron approached. This was solved by the use of short unweighted wires dragging from the wing-tips, rather than the long single cable that was first utilized, and which suspended a lead weight some three hundred feet below and behind the airship.

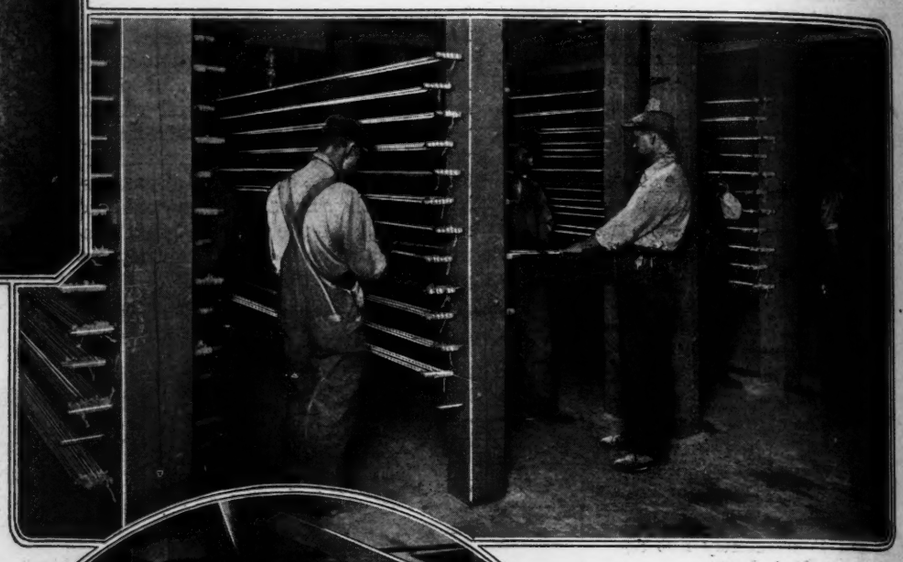
Future of the Radio-Telephone

It is difficult to foresee the future of airplane radio-telephony, for its greatest value is doubtless in connection with group flying. But the day of the commercial airplane seems dawning. When groups of airplanes travel together from city to city, their passengers will surely appreciate the radio-telephone.

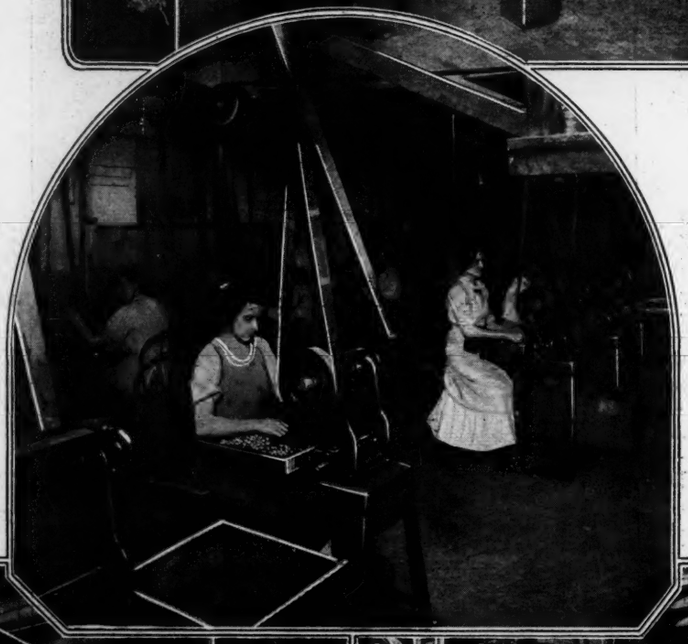
Of Their Bones Are Buttons



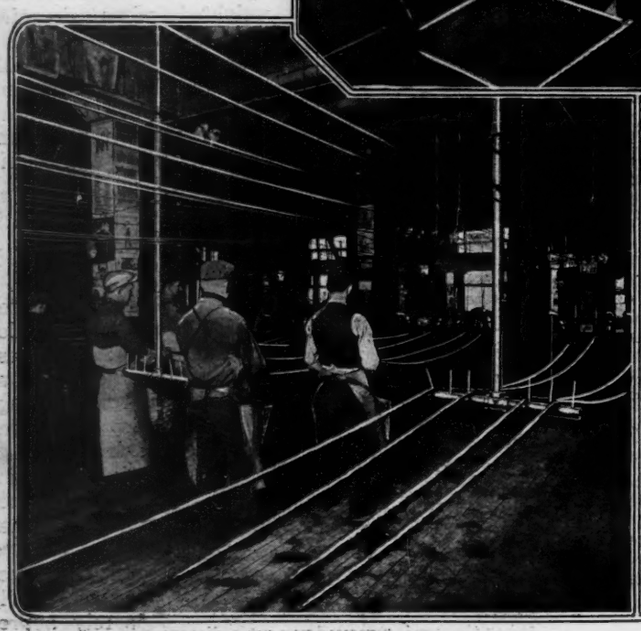
The hair on pigs' backs grows in silky waves and makes excellent stuffing for mattresses. But a 50-lb. bale of pigs' hair is so large that its traveling expenses are heavy. So when hair is shipped it travels as rope. It is wound up tightly before it starts, and is fluffed out again after it arrives. There is just as much hair in this rope as there is in the pile behind it



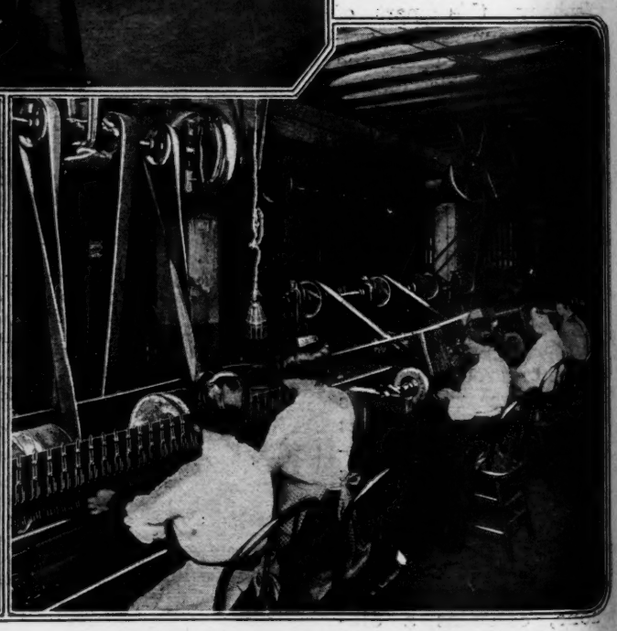
These are guts. They are cut and stretched into long strings and then fastened on pegs to dry. 'Tis on guts like these that Mischa Elman makes a living —they are to be turned into violin strings. The list of things in everyday use made from the intestines of animals is a long one. You will see it graphically portrayed in the large picture on the page opposite this



Each machine gnaws on a bone and bites off buttons. As the buttons dribble out, girls catch them in small trays, and when the trays are full they dump the buttons into big boxes on the floor

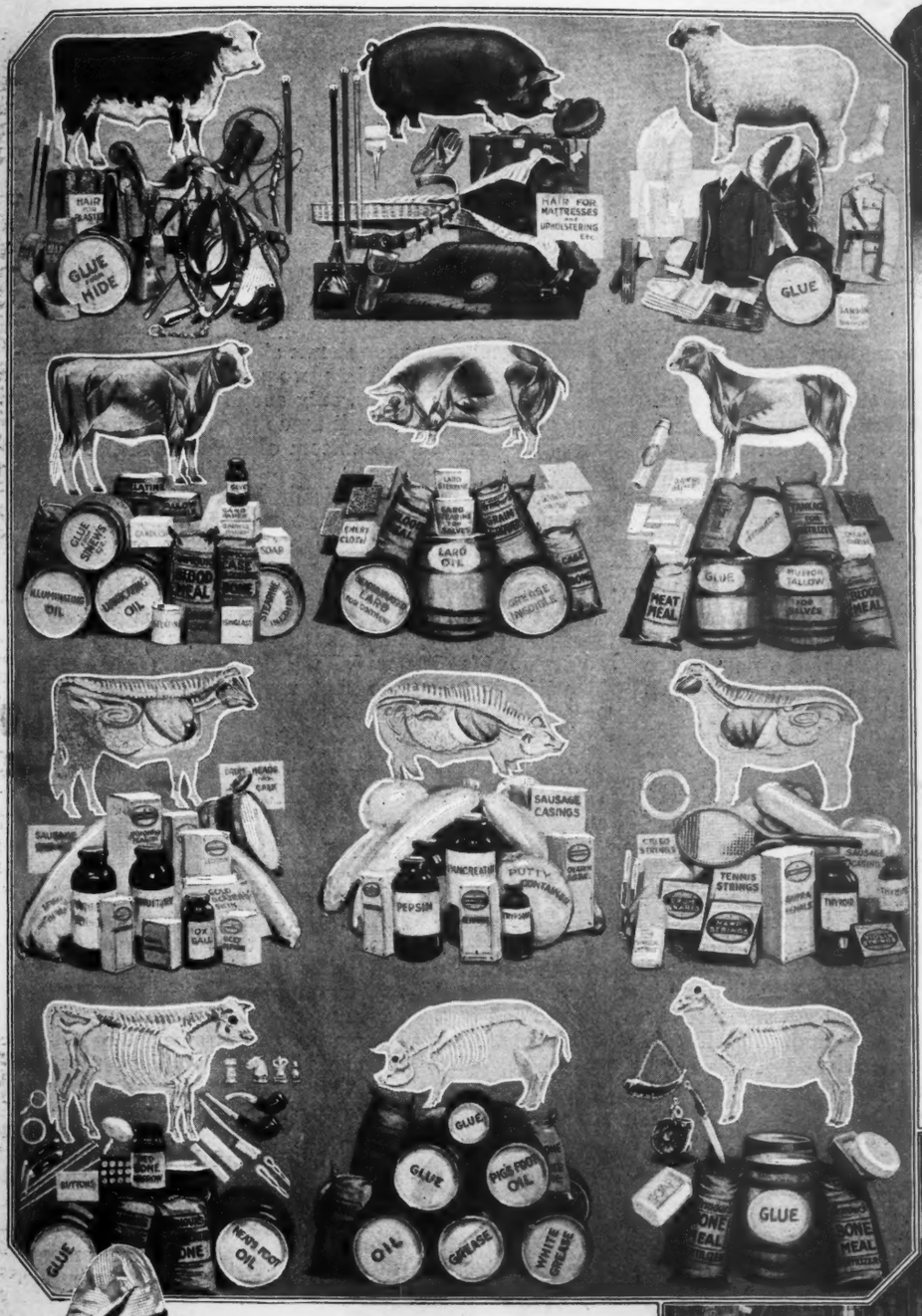


Pigs' hair is very hard to curl, but curling is necessary to make it fluffy enough for stuffing. So, instead of using a curling-iron, the hair-dressers spin it into long ropes, wet it, and then loop it around the horns of cows to dry



The bone trimmings on cows' heads are turned into bone trimmings for ladies' heads—in other words, horns are turned into hairpins. Here are some bone hairpins getting a final polish before going out into the world

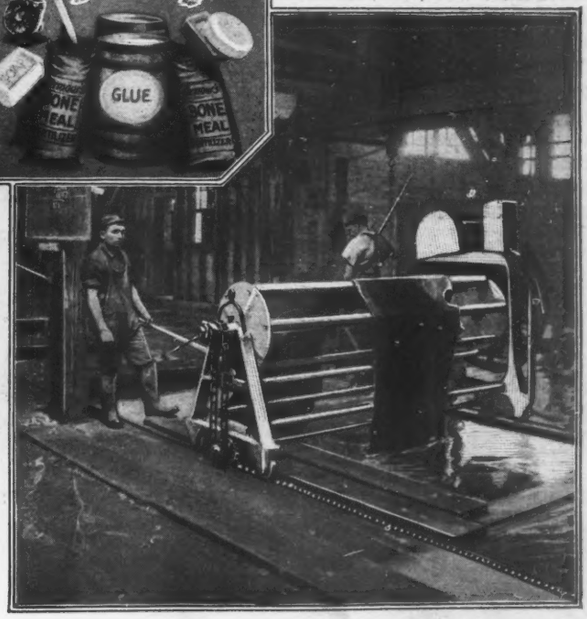
Made—Coats that Were Their Hides



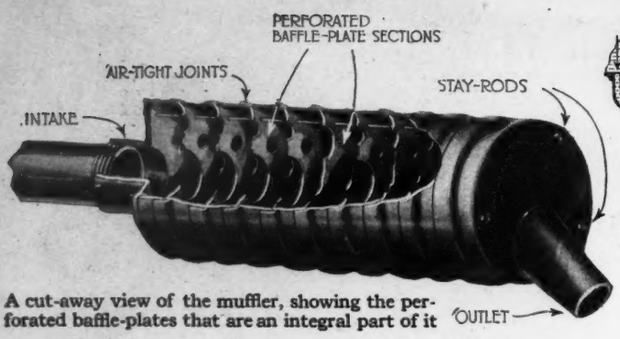
Ten bales of roped pigs' hair take up just about as much room as one bale of fluffed pigs' hair. If you don't believe it, go back to the upper left-hand corner of page 56

When a cow, pig, or lamb goes to market, its meat is turned into beef, pork, or mutton. What happens to its hoof, hide, horn, and other meatless parts? Start with the top row of this picture. There you will see some of the products that are made from their respective hides; second row, from their muscles; below that, from their vitals, and lastly, from their bones. By the time they have reached the last row, all three animals look like "the ghosts of Dead-Pig Farm"

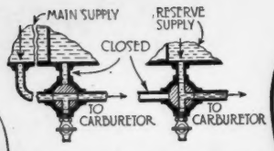
After the hide is ripped off an animal's back, it is given a series of lime baths, going from one to another over a hide reel. When it comes from the last one it is hairless—the hairs all came out in the wash

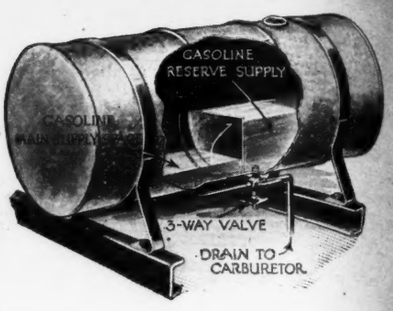


Here are the guts again — this time made into surgical ligatures for binding arteries and veins during operations. They are kept free from dampness in test-tubes



A cut-away view of the muffler, showing the perforated baffle-plates that are an integral part of it





One tank within another, which automatically holds its supply of gasoline until needed, is made possible by the use of a three-way valve

Here's a Muffler that Can't Possibly Blow Up

AS a general thing, automobile mufflers begin to rattle when the inside baffle-plates work loose from the outer shell. Troubles of this nature are eliminated in the new type of muffler shown in the illustration above.

This is accomplished by flanging the outer circumference so that each flange of the baffle-plate overlaps the section next to it, and thus makes the baffle-plate an integral part of the shell. By this type of construction any chance of the baffle-plates becoming loose is eliminated and the shell strengthened so that they will not blow up.

The plates have openings cut in them as shown, so that the exhaust gases are made to travel in an irregular path and in this way hold them back to permit of their gradual expansion. The headers or end plates of the muffler are made of malleable iron, and are held together by tie-rods running clear through from one to the other.

This Gasoline-Tank Has a Fool-Proof Reserve

THE gasoline reserve shown above is fool-proof because the tank is divided into two parts by a transverse plate which gives two supplies, only one of which can be drawn from at one time. This is made possible by the use of a three-way valve in the bottom of the tank in the reserve supply.

Filling the tank automatically fills both supplies, but in draining the tank one supply always remains full. When the engine stops for lack of fuel, as when one supply is exhausted, the valve is turned and the other supply used to reach a gasoline station.

If the main supply is used first, the valve is open to the pipe leading to that end of the tank, to the carbureter, and to the drain, which is closed. When the supply is exhausted, the valve is turned so that the reserve supply is open and the drain-cock closed.

An Adjustable Body Support for Trucks

Its sub-frame fits a standard type of body to trucks of all sizes

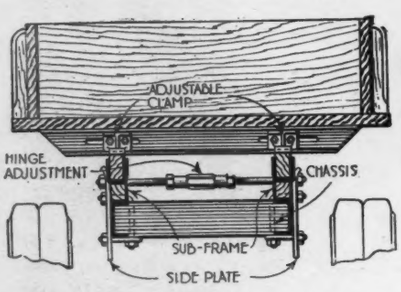
UNTIL the adjustable type of sub-frame shown herewith was worked out by a Columbus, (Ohio) body-maker, the fitting of one standard type of body to trucks of different frame widths and lengths was done in a more or less hit-or-miss method. In this body all of the adjustments are made in a special sub-frame mounted on longitudinal wood sills directly on top of the truck chassis frame. There are four adjustments.

The first adjustment is for any variation in the width of the truck frame, and is made by the use of two clamps on each cross-member of the body sub-frame. These clamps are attached to the truck sill and bolted to the cross-member at varying corresponding widths by passing the bolts through horizontal slots cut in the cross-member.

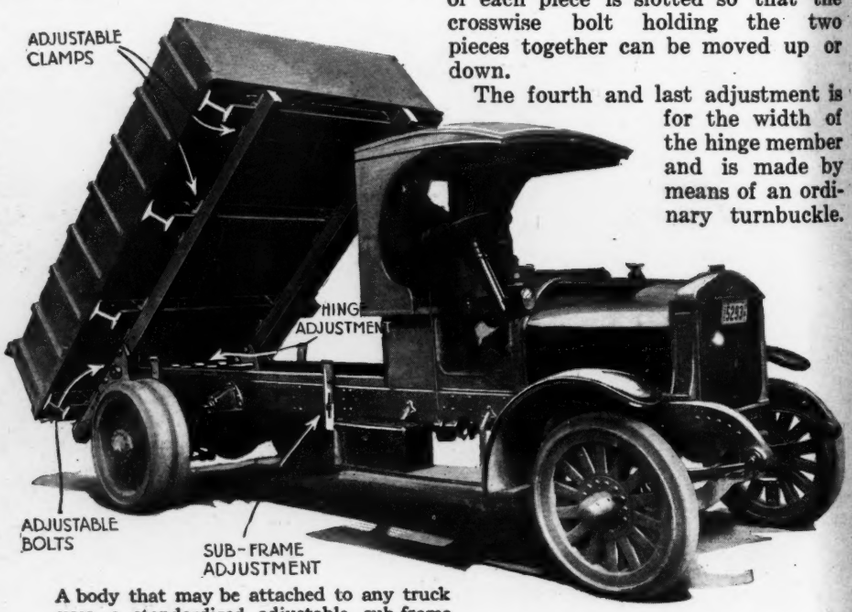
The second adjustment is for the longitudinal position, and is secured by a series of three holes drilled in a horizontal line in the hinge casting when an end-dumping body is desired.

The third adjustment is for the depth of the truck frame and wood sill. This is secured by sets of two flat metal pieces with hooked tops, which fit into the bottom flange of the I-beam body sub-frame. The bottom of each piece is slotted so that the crosswise bolt holding the two pieces together can be moved up or down.

The fourth and last adjustment is for the width of the hinge member and is made by means of an ordinary turnbuckle.



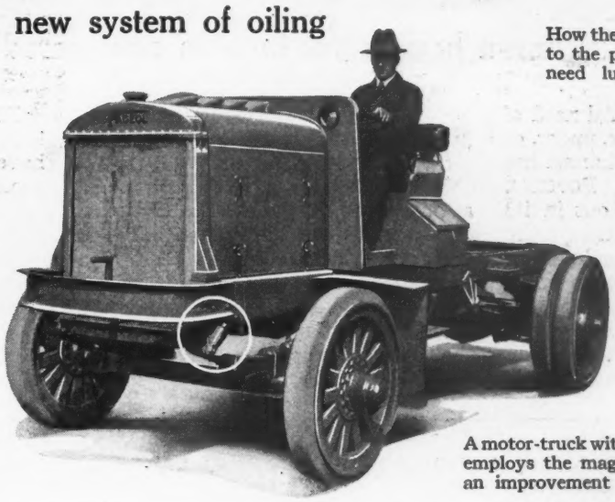
Showing how the three adjustments are obtained for width, length, and depth



A body that may be attached to any truck uses a standardized adjustable sub-frame

This Motor-Truck Has No Grease-Cups

A new system of oiling



How the oil is fed to the parts that need lubrication

A motor-truck without grease-cups, which employs the magazine oiling system, is an improvement over present methods

OWNERS of motor-trucks will tell you that the next worst failing in the average freight vehicle driver, after speeding, is the difficulty of getting him to turn up the grease-cups.

Grease-cups are generally placed on the front and rear spring hangers and shackles, propeller-shaft bearings, and steering-gear mechanism. To reach the grease-cups on the propeller-shaft the driver must crawl under the truck. But some drivers become so careless that they neglect to fill or turn up regularly even the cups on the spring hangers, which are easy to get at. If these are not well lubricated the springs, of course, do not function properly.

To overcome these difficulties, C. T. Myers, a consulting truck engineer of Avenel, N. J., has evolved a new system of chassis oiling called magazine lubrication. Oil is used instead of grease, and it is kept in a reservoir or magazine chamber from which it is fed through capillary action to the parts to be oiled by wicks.

Even if the oil is dirty, the dirt is not fed to the bearing to be lubricated, because the wicks will not carry it. The oil feeds only when the truck is in motion, and any seepage drops down on the spring leaves, preventing rust.

Controlling the Speed Automatically

How the starting and lighting equipment is adapted for this purpose

A RECENT modification of the usual starting and lighting equipment of gasoline engines used on tractors is its adaptation to engine speed control and governing without the addition of delicate mechanisms. It comprises a six-volt storage battery, a starting motor, a control-box containing the lighting and ignition switch, as well as the rheostat for the governor-generator. The latter has built integral with it the ignition system—induction coil, primary circuit breaker, and distributor.

The governor-generator proper is the usual form of four-pole, shunt-wound machine. The field frame, however, instead of being rigidly attached to the engine base, is supported at both ends inside its housing on trunnions. This permits the field frame to turn through an arc of thirty degrees, but in no way interferes with the armature rotation. The field frame has attached to it a lever connected to the carburetor valve by a link, so that any movement of the frame is communicated to the valve.

A spiral spring is provided at one end of the generator housing, which acts to turn the frame in a direction opposite to that of the armature rotation. A dash-pot retards any sudden movement of the field frame.

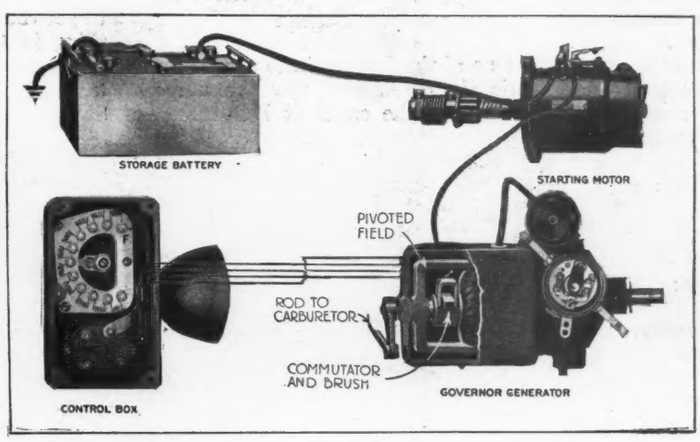
When the armature is caused to rotate in the field frame, a current is generated therein, part of which flows through the fields and energizes them. The magnetism of the fields, acting on the armature, creates a magnetic drag that turns the field frame in the direction of the armature rotation and compresses the spiral spring.

The turning effort imparted to the field frame can be effected either by altering the resistance in the field circuit, and consequently the current, or by a change in the speed of the armature.

The engine speed can be controlled by the rheostat in the control-box. When the rheostat is on the first point, all the resistance is cut out of the field circuit and the current in the fields will be at maximum. The drag on the armature then being greatest will turn the fields through a large arc and thus close the carburetor throttle, giving a low speed.

As the controller is advanced from point to point, resistance is added in the field circuit and the magnetic drag is lessened. The spiral spring then acts to turn the fields back and open the throttle, increasing the speed.

The governing of the engine speed is based on the second method of changing the drag; namely, an increase of armature speed will increase the drag. After any engine speed is obtained by adjusting the controller it will be maintained, for should the engine speed up due to a decrease in the load the increased drag between the fields and the armature will turn the former to close the throttle and reduce the speed.



A lighting and starting equipment that embodies also a governor for automatic engine speed control

Building a Bridge Under Water

Neither a tunnel nor a bridge, yet both in one, paradoxical as it sounds

By F. W. Fitzpatrick

FOR years the commercial need of a railway crossing over, under, or through the British Channel has been recognized, as the POPULAR SCIENCE MONTHLY pointed out in its issue of December, 1918. Always the bugaboo of an invasion of England has risen to throw cold Channel water on these projects. Today a railway link between the two Allies is deemed absolutely essential. Had there been such a crossing it would have undoubtedly facilitated the handling of troops and supplies during the war.

In England there is a Commission already at work studying plans, finances, etc., for the project. So far, a tunnel *bored* under the bottom of the Channel is the one plan receiving most serious attention, chiefly because there is a fear that any other form of structure may be blown up by a mine or depth bomb.

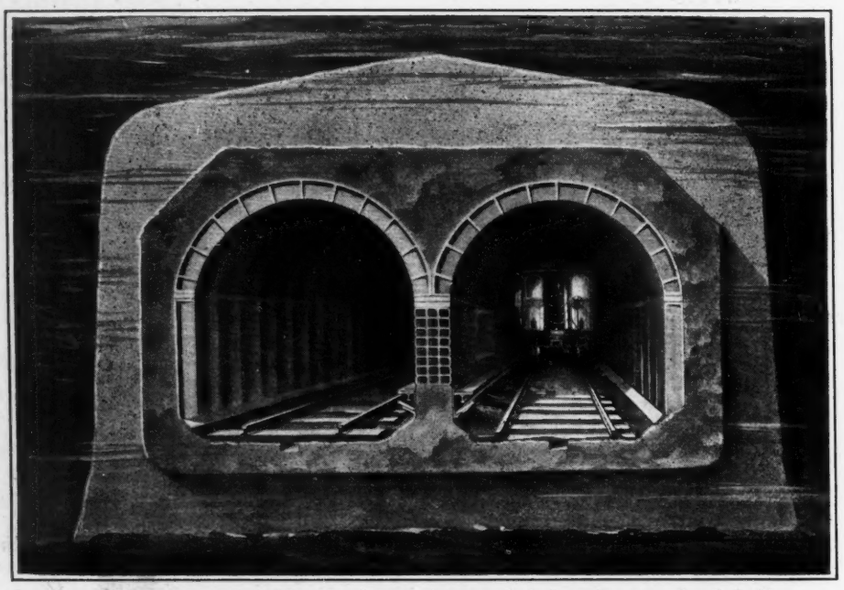
Years ago twenty-odd schemes were submitted. One much talked of was a trackway laid on the bottom, on which track a sort of platform could be hauled back and forth across the Channel. In turn, a train, run from the ground track upon this moving platform, could be whisked across on the surface of the water, without interfering in any way with the rest of navigation.

This year I have submitted to the Commission a project for effecting the crossing by means of a "subaqueous bridge" — neither a tunnel nor a bridge, and yet both in one, paradoxical as that may seem.

It Is No Longer in the Experimental Stage

There are several examples of river crossings in this country, one in France, one in England, and one in Russia, and plans have been drawn up for many such crossings. The scheme is no longer in the experimental stage.

Where there is very deep water, such as an ocean inlet, to cross, a body 250 or more feet deep, of course the difficulties multiply. Long spindle-legged concrete or stone anchors or "supporting piers" have to be built unless the tube is to rest upon the bottom. In the latter case the approach grades are bored under the bottom, and in the former case the construction of such piers a hundred feet or so high and all under water is an undertaking of considerable magnitude. But in shallow water this subaqueous bridge is ideal.



"My subaqueous bridge crossing consists merely in lowering a previously built tube into place, either right on the bottom of the waterway or raised above the bottom on piers," says Mr. Fitzpatrick, the inventor of this system

One of the First Projects Was for Duluth

One of the first projects of this kind seriously considered was the narrow crossing of the canal at Duluth.

The canal at this point cuts a long strip of sandy shoal that would have been an admirable and much needed freight terminal. But the authorities were frightened by its novelty.

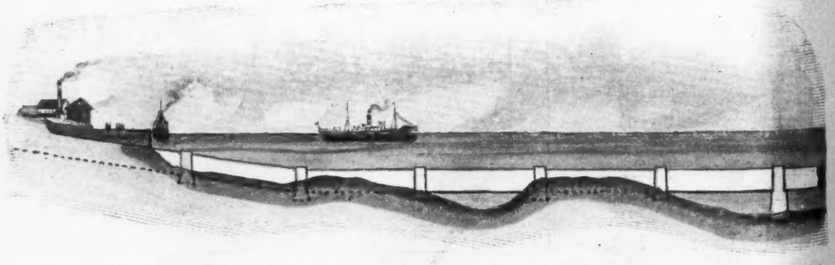
There is a crossing there now, an aerial bridge that took every bit of ingenuity I possessed to get approved by the War Department, and that affords only a crossing for vehicles and pedestrians.

The scheme is ideal for the crossing from San Francisco to Oakland, where in the seven miles of water there is no greater depth than seventy-five feet.

San Francisco's Needs

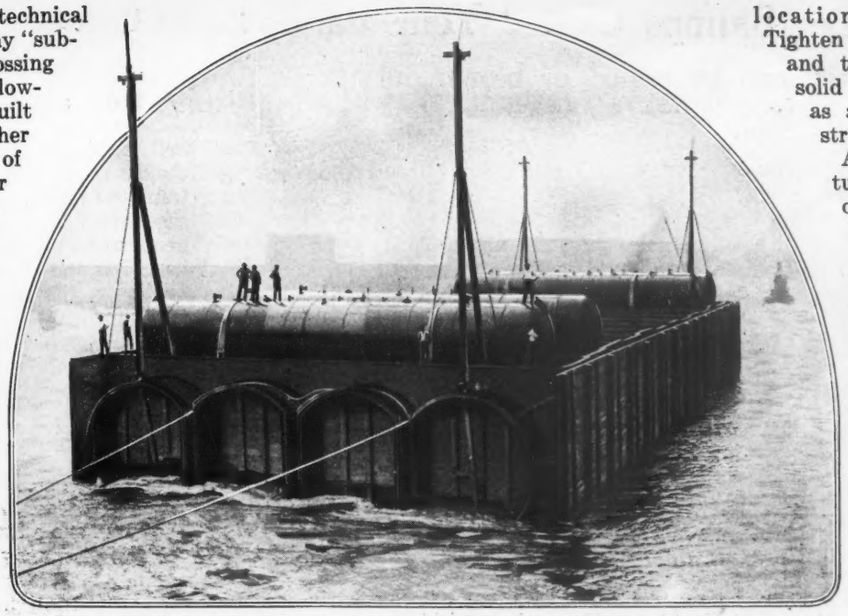
There has been a good deal of talk of a bridge, then of a tunnel. It is generally recognized that something must be done to relieve the railroad isolation that now grips San Francisco and handicaps its terminal railway business. About seven years ago the newspapers and local engineers were quite enthusiastic about this subaqueous bridge crossing, but politics and lack of funds and the war prevented the plan from being actually realized.

Just now there is a movement afoot to get the authorities to doing something in that crossing matter. It is important, necessary, and would be of tremendous benefit to the city of San Francisco.



At intervals there will be lighthouse-like vent-towers projecting out of the water to the proper place, and sunk into position on the piers. With the ends of the tube

Divested of all technical details and terms, my "subaqueous bridge" crossing consists merely in lowering a previously built tube into place, either right on the bottom of the waterway or raised above the bottom on piers. It is the simplest, the most effective, the most cheaply maintained and least expensive water crossing.



That Mr. Fitzpatrick's scheme is not impracticable is shown by this picture of the process carried out in building the portion of the New York subway that goes underneath the Harlem River. In this case the sections were built of steel instead of concrete; but they were sunk, as Mr. Fitzpatrick advocates, in a carefully prepared trench. This was in the year 1913

Built Like Concrete Ships

My plans are for a concrete tube, made in sections ashore, as we build concrete ships. Sections about three hundred feet long are the more easily handled. They are square, large enough for a double track, provision being made for drain and ventilating pipes, electric wires, etc. Each section has a temporary bulkhead at the ends and is launched as you would a ship, and towed to the point where it is to be sunk in a trench previously dredged or on piers built in place.

To sink the tube section the bulkheads are knocked out. The water fills the tube, and it sinks, directed by divers, into its proper place. The ends are fastened to the other sections. Another and another section is lowered. When all are in place the water is pumped out, the connections perfected, tracks laid, lights, ventilation, and drainage installed.

Your "subaqueous" bridge" is complete and ready for operation—the cheapest and best water crossing ever devised, one not subject to winds and storms like a bridge, nor disturbed by currents or tides, nor painfully bored underground. If the traffic becomes too great for two tracks, another double-track tube is laid alongside the first, and another and another later on, as needed. Thus the "subaqueous bridge" can develop without in any way disturbing the first tube or its traffic.

How the Sections Are Joined Together

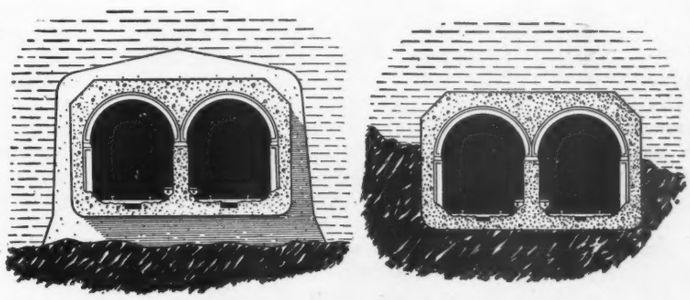
The joints in these tubes are so devised that when the two sections are butted together the easing into exact location is automatic. Tighten one line of bolts and the juncture is as solid and water-tight as any part of the structure.

At the ends of the tunnel or subaqueous bridge the approaches lead through open cuts or troughs exactly as one would expect for the regular bored tunnel under a waterway bottom.

Some twenty years ago definite plans and estimates were made for four crossings, railway, street-car, and street traffic, near the Cortlandt Street ferry line into New York. The crossing would have required nine anchorages, and was estimated to cost $3,000,000.

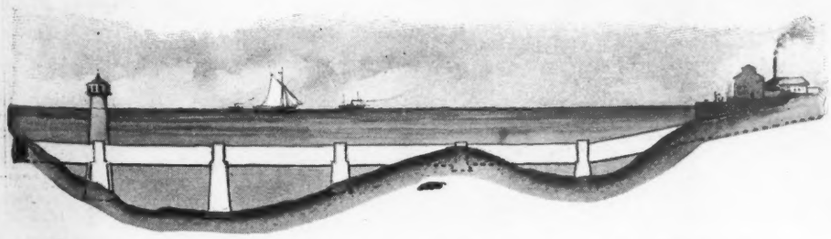
Careful plans are being made at present for the Dover-Calais Channel crossing. What will be the cost? It is too early to state definitely, but we have gone far enough to be sure that the cost would not be in excess of forty per cent of what a regular bored tunnel under the Channel would be.

The tube idea was at first opposed by engineers. Now it is regarded as fundamentally correct. It was thus that the New York subway was built under the Harlem River.



The really troublesome problem would be to keep the tube from floating off from the anchor piers. In these two drawings Mr. Fitzpatrick shows how to prevent such a possibility

At a conference of railroad men before whom I was advocating this tube crossing for a certain river here, the chief engineer of one of our greatest systems was loud in his opposition. Finally, as a clincher, he suggested that the piers necessary to *support* the tube would have to be wonderfully strong, and that the load in the tube would be so great as to produce a sag in the middle of each section. It was only after much bantering on the part of his colleagues, and the illustration of trying to keep a closed glass tube down in a glass of water, that it dawned upon his expert mind that the piers were not for support, but for anchorage. The really troublesome problem would be to keep the tube down in place and prevent it from *floating* up off its anchor piers.



aid in ventilation. The concrete tubes are to be built in sections ashore, towed to sections temporarily closed for transit, the tubes could be towed like large scows

Don't Let Stumps Clutter Your Land

They can be pulled or blown out

To blow up a stump, first drill a charge hole six inches below ground with an electric drill

TREE-STUMPS are just so much dead wood taking up valuable space and yielding nothing in return. The sooner they are uprooted the better. Many kinds of stump-pullers are used in different places.

In Michigan a tripod stump-puller is used exclusively. With it four men and four horses can uproot seventy-nine stumps a day. But it can be operated in only a few positions.

There are two types of hand stump-pullers. One of these jerks the stump up from the side. The other lifts the tree up, like the tripod puller; but, unlike the tripod type, it can be operated in almost any position.

But stumps can also be blown out without harm to anything in the neighborhood. The charge should be placed in the wood itself to obtain the best results, which means boring a hole. An electric drill is used for this.

A turpentine company operating in the long-leaf pine section of the South uses the electrical drill with great success. The machinery includes a small horizontal gasoline engine and a dynamo, which can be transported on wagons or skids drawn by a team. Two electric drills using 1½-in. augers are driven by this apparatus.

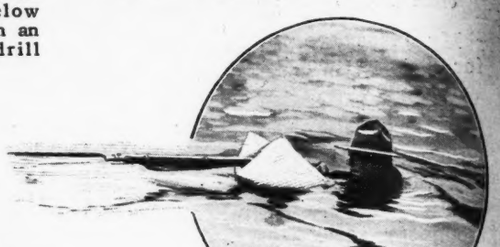
Holes are bored into the stumps at points from six to ten inches below the surface. These holes penetrate the stumps to such a depth that the charge can be placed at or near the center of the tap-root. *Bang!* No more stump.

The tripod puller grasps the stump like a pair of forceps and lifts it out of the ground

In Case of Shipwreck Grab a Pillow-Slip

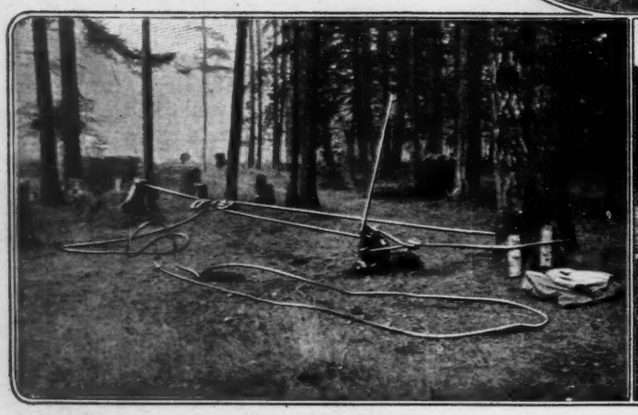
A MAN attired in regulation army uniform, with a rifle and cartridge-belt, appears at Palm Beach. Holding a pillow-case in his hand, he wades out from the shore. He dips the pillow-case into the water, whirls it about his head, and thus fills it with air. Then he twists the mouth of the slip. Lo! he has a life-preserver, inflated and ready for use.

He places his rifle across the pillow-slip and propels himself through the water at a fair speed merely by kicking in the usual swimmer fashion. The supporting qualities of this improvised preserver buoy up the man and his gun, when at rest, without swimming movements. After floating about for fifteen minutes, the man comes ashore and turns over his outfit to a totally inexperienced young man, who duplicates the feat with perfect ease.

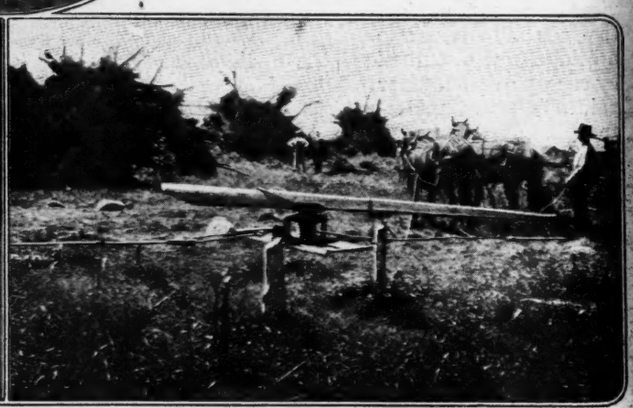


Having moistened a pillow-slip, he inflates it by whirling it around, and then uses it for a life-preserver

For simplicity and quick use the pillow-slip commends itself as a possible means of saving life. Any camping party has a supply of pillows on which to rest the weary head, and a few experiments such as this would be of great interest and possibly of great use. A company of soldiers might ford a river in this manner. Only a second is required to fill the slip with air, and preparations are all complete.



The operator jerks the handle of the stump-puller, which tightens a rope round a tree and a line attached to the stump



The horses turn the capstan, which tightens the rope attached to the stump, increasing the pull until the stump is torn up

Radium Turns Darkness into Light

This 57 has nothing to do with the well known varieties. It is a house number illuminated so it can be read at night

THE market price of radium is $120,000 a gram, and a gram is less than one five hundredth part of a pound. Then how can people afford radium-dabbed watches, clocks, and house numbers? Because radium is marvelously self-luminous, and a few micrograms (one of which is a millionth part of a gram) mixed with zinc sulphide crystals will paint your house number and keep it luminous for years. That is because zinc sulphide, being itself phosphorescent, is sensitive to radium rays.

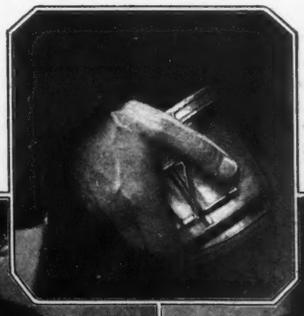
Strange as it may seem, the more radium used the shorter the luminous life of the compound.

If You Must Have Something Hot

SOON a bottle found in a gentleman's hip pocket will land him in jail as quickly as a gun will. How, then, can you warm your chilled blood when traveling? Slip a can like the one shown below in your side pocket. Then, if you are searched and the worthy law enforcer pulls out the can, he will find that the lid is really a saucer and the can a cup. Inside he will find a lamp, a box full of spoons, matches, tea, and a strainer.

The lamp (a spirit one!) has an unfolding base, and a cap to prevent the escape of the spirit odor. The lamp is placed within a stand, which likewise comes out of the cup. Then the cup (its collapsible handle extended) is filled with water and the tea is made. Of course you don't have to drink tea; you might fix bouillon, or even hot lemonade.

Before you start on a long trip, slip a can like this in your pocket



It will be most useful when you get that faint feeling about four in the afternoon

When the kit is opened, you find a complete outfit for making tea

The can becomes first a saucepan and later a cup from which you drink

The acrobat is always a prime favorite in the East, where dexterity is traditionally admired for its own sake

The Acrobatic Japanese in Siam

IN the far East, land of street fairs, the Japanese juggler is a familiar figure. Even so simple a feat as that shown above, which seems to be little more than the manipulation of a giant swing, is holding the absorbed interest of the Siamese and Malays. The performers will pass the hat for stray coppers when their stunt is over, and, no matter how poor or wretched the audience may be, enough will be forth-coming to compensate them for their work.

Now and then a traveling troupe will set up a canvas curtain, station a man with a drum outside the entrance to attract attention, and collect a small admission fee in advance. But when it comes to the star act, the trapeze performer ascends his trapeze high in the air in full sight of everybody. The operators inside surely would not begrudge those less well off than themselves the benefit of a free entertainment. Thus reasons the Oriental mind.

Making Life a Little Safer for the Lineman

WHAT look like bandages on the wires on the sky-scraping pole at the right are not put there for the protection of the wires, but as an insurance against electrocution for the workmen. The danger of working among wires carrying high-voltage currents is one of the lineman's joy-killers, and no device has yet been invented that will enable him with impunity to indulge in capers among wires carrying currents with voltages of 33,000 and up.

The bandage-like protector-shield reduces the risk to a minimum and enables a careful man to go about his work in comparative safety.

The shield, made of heavily insulated wraps fastened about the wires, enables the lineman to stand on the cross-pieces, or even on the network of wires, without the haunting fear that an incautious movement will bring him in contact with a death-dealing current.

This simple precaution renders a formerly hazardous job comparatively safe.

Quick death flows through these wires beneath the hands and feet of the lineman, and contact with an unprotected wire carrying a voltage of 33,000 or more means a hurry-up call to kingdom come. The bandage-like shields are the lineman's life-savers on the wires

You Can Hammer Nails into This Concrete

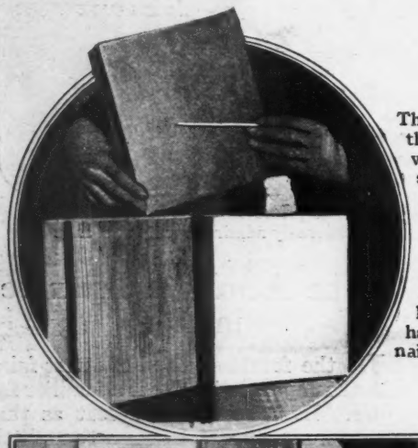
CONCRETE came into use as a building material because it could be easily molded into shape. In this respect it is far superior to stone, brick, and wood, and costs no more. But when the molded concrete dries it becomes very hard—almost brittle. If you drive a nail into concrete, it crumbles.

Now comes a new concrete into which nails may be hammered. It is a new building material which has been used with great success in the Parliament Building at Ottawa, Canada. It is prepared and sacked like concrete, mixed with sand and water in the same manner, and is similarly applied, shoveled, tamped, and smoothed. The time required for setting is about the same, and so is its strength. It is lighter and smoother than concrete, and it can be laid without forms on a sloping surface.

Its smoothness makes it useful for flooring. Sometimes it is given simply a high polish, and sometimes it is stained and grained to resemble wood. If neither of these is desired, hard-wood flooring or linoleum can be tacked down on it.

A layer of this concrete inserted in the cement or hollow tile around windows, doors, and near the base makes it easy for the carpenters to fasten the framework and base-board in place. One of the novel uses in the Parliament Building is for the ceiling in the large chamber. This concrete was selected because it can be readily plastered to the metal lathing.

Just after one floor of the Parliament Building was finished and the next floor begun, the new floor's plans were changed. The workmen tore down the work they had done, and all the scaffolding, dropping them all on the newly finished floor and trampling on it with their hob-nailed boots. Yet the floor was not even scratched. Mr. Viens, director of the public works laboratory for testing material at Ottawa, is the discoverer of this marvelous material.



The upper slab is the new concrete with its top layer stained and grained to resemble wood: the lower right slab is the same concrete highly polished; and the left slab has a square of hard-wood flooring nailed to its surface

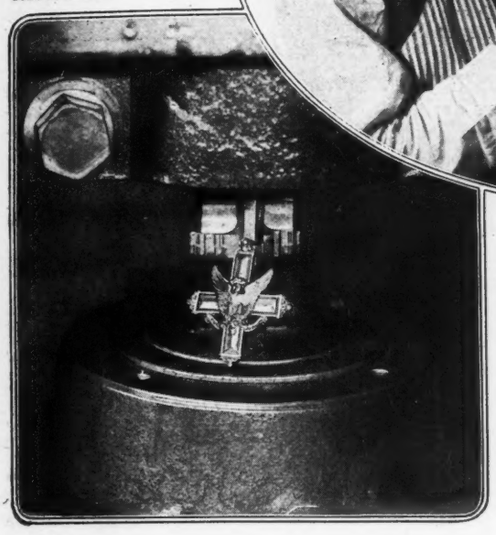
The new concrete is prepared and sacked like concrete, mixed with sand and water in the same fashion, and when applied is shoveled into place, tamped, and smoothed. The time required for setting is about the same as concrete

This strange composition does not break or crumble when nails or screws are driven into it

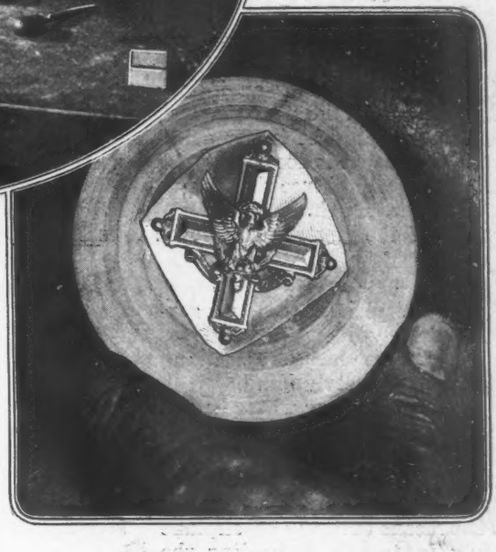
The D.S.C.—Our Medal for Valor

Photographs © International Film Service

The cross is in the die, ready to be stamped. Two hundred and fifty tons pressure must be applied ten times before it comes out again



Below it is shown ready to move into the room shown at the left, where finishers will trim off the edges and make it fit for service



The Distinguished Service Cross is the American equivalent for the French *Croix de Guerre* and the English Victoria Cross. It was born during the Great War, just after our men went to France to fight. The crosses are made in the Philadelphia mint

Bonar Law Has His Own Airplane

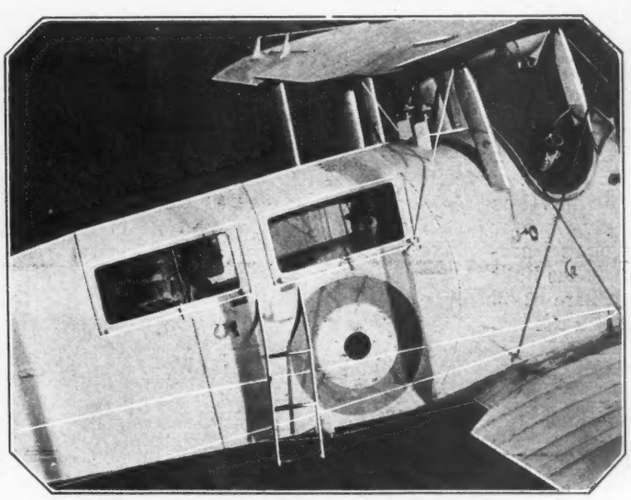
In which he flies from London to Paris

THIS is Bonar Law's own special airplane in which he flies from London to Paris when he feels the need thereof. Our statesmen, however, must be content with limousines, although we own more airplanes than we have use for just now. The reason is lack of landing-places.

An airplane travels so swiftly that it needs large, flat ground areas in which to start and land. There are few of these in our large cities and between them. That is one reason why attempts to fly from New York to Chicago have been unsuccessful, and is the main reason why many airplanes are not being used.

London has its airplane field near by, and so has Paris. Although one daring Frenchman recently landed on a roof, that stunt is too dangerous to become fashionable.

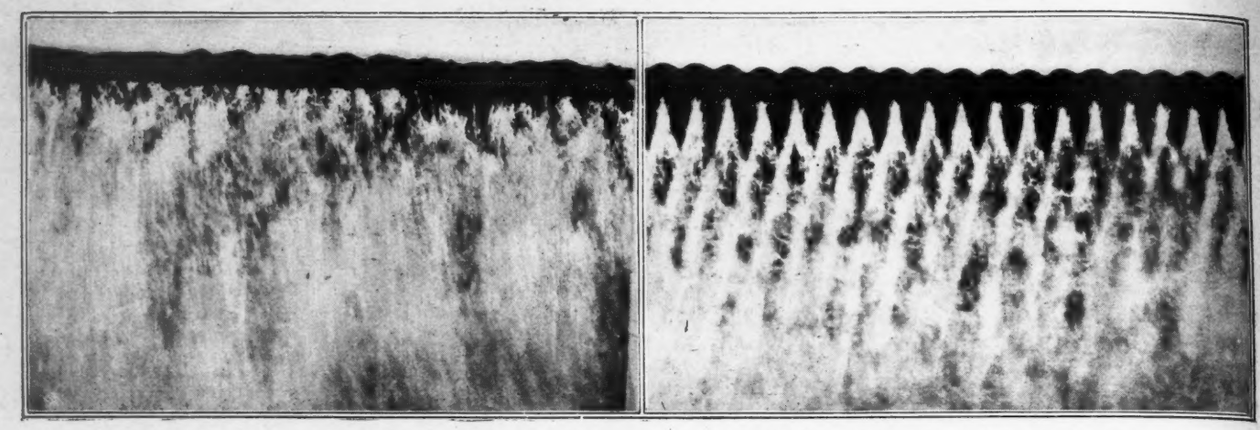
The comforts of the modern airplane contrast sharply with the airplane of ten years ago. Do you remember the old type of plane in which the pilot sat in a seat which jutted out from the plane and was poised precariously over nothing? An observer had to sit alongside of him and grow dizzy every time he looked down. The modern plane is built much like a limousine, with a driver's seat up front and a comfortable cabin behind.



Neither of the men sitting in the cabin is Bonar Law. Most likely they are photographers who like to be photographed

Take, for example, this plane of Bonar Law's. He climbs up a ladder, drops through a hole in the lid, and finds himself in an electrically heated and lighted cabin containing two leather seats, a table, and a small baggage-room. He might take another person with him, dictate letters, or discuss the question of the hour during his brief, smooth flight.

Which Is the Right Glass for Your Skylight?



Light passing through pebbled glass is uniformly diffused by the irregular unevennesses of the surface

Glass with one plane and smooth and one ribbed surface refracts the light in a regular pattern and also causes diffusion

SKYLIGHTS offer an ideal method of illumination if the proper kind of glass is used. Ordinary window-glass or plate-glass is not suitable for obtaining the best results, because it does not diffuse the light passing through it. Glass will diffuse the light only when one or both of its surfaces are rough.

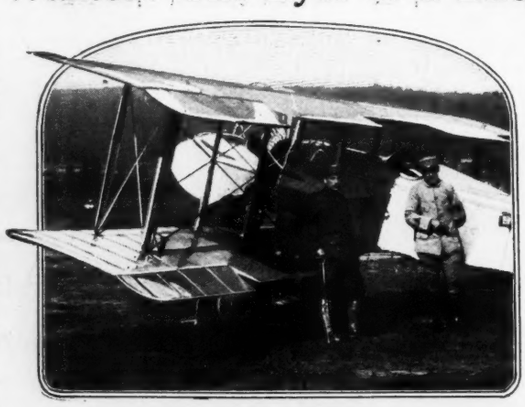
One of the illustrations above shows a cross-section of a piece of rough glass commonly called "pebbled." The light rays are broken up by the irregular curves of the surfaces, and the light becomes uniformly diffused. The other picture shows the effect produced by light passing through a plate of glass with one smooth and one ribbed surface. The rays are refracted by the ribs, and form a regular pattern which is clearly noticeable in the picture.

Wanted: The Eyes of a Bird

THE airplane of to-day is surprisingly like a bird. But the creature has one striking defect—it is nearly blind.

Put the observer where he can be the eyes of the craft, and you must place the propeller where it will revolve through the very space occupied by the fuselage. That means cutting the airplane body in two and holding the parts together by nothing more than the thin spine that forms the axis of the propeller. Sight is gained at the expense of strength.

And if we try to gain strength through outside framing inclosing the propeller and connected with some part of the machine, the clean, efficient outline of the airplane is broken.



By placing the propeller back of the observer's seat the man-made bird is no longer blind, but the airplane body is cut in two and loses strength

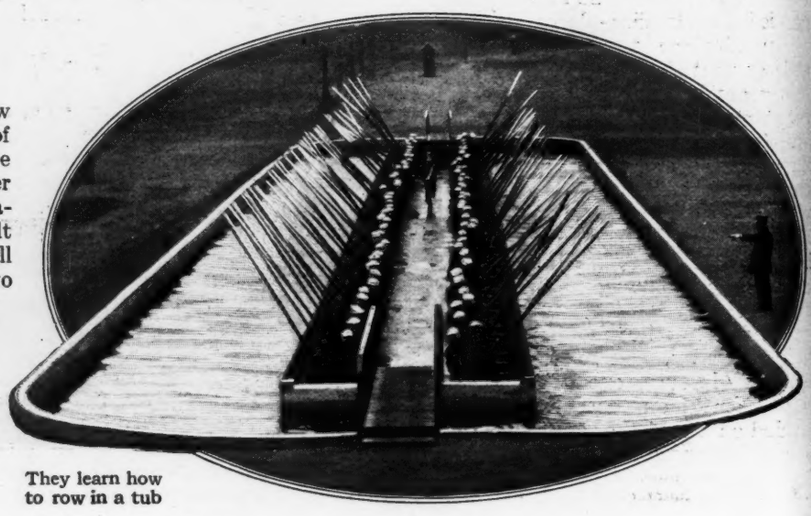
On the other hand, it might be thought that in the French airplane shown here the propeller is so hidden in the cleft fuselage that it must lose power. That is a mistaken idea, since it is only the outer ends of the blades that really drive the machine.

An American inventor, Gallaudet, has made a rather better job of the problem by halving the fuselage nearer the tail, where it is narrower and needs no bracing, and placing the propeller directly behind the wings. But the best solution may come from the optician. He may be able to invent an artificial "eye" placed in front. It is possible that the periscope may be perfected for this purpose.

Pull, Pull Together!

THEY are getting their first lesson in crew pulling, and from the wild way some of them are waving their oars it's the first time they ever rowed at all. The Navy is ever confronted with this job of making real seamen out of green sailors, and so it has built rowing-tanks like the one shown here at all large naval stations. The tank and the two rows of seats are made of concrete.

The instructor stands at the tank's edge, and shouts orders to the hard-working crew, who can't get away from the sound of his voice no matter how hard they pull. Up and down the aisle between the rows runs another instructor, shouting through a megaphone at erring individuals.



They learn how to row in a tub

It Tells the Aviator if He's Upside Down

WHEN an aviator gets into a fog, his position is perilous. Since he can't see the ground he doesn't know whether he is on an even keel or not. He has even been known to fly upside down for a short time and not know it.

Dr. James Pentz, of New York, has invented a compass that not only tells the aviator his north and south, but also tells him whether he is upside down. The compass-card rests freely on a surface of kerosene inclosed in a glass globe. Liquid will not stand on its head for any length of time, but will settle down in the position gravity meant it to.

In his first attempt Dr. Pentz attached the compass-card to the globe, which deprived it of the necessary freedom. He complained of this to his sympathetic wife, who pulled a hairpin from her hair, drove it into a cork, and floated it, thus helping to solve the problem.

The compass is fastened in front of the pilot, where it takes the place of three other instruments: it gives direction, the points of the compass, and the angle at which the airplane may be flying

Airplanes Spy on Outlaw Cotton-Growers

AIRPLANES are now aiding agriculture. They have not yet taken to pulling plows, but they are playing an important part in the unending battle against the devastating pink bollworm that has been trying to invade the United States from Mexico.

In southern Texas, where the bollworm first crossed the border, there are cottonless zones maintained as barriers against the advance of the worm. Most of the cotton-growers have recognized the wisdom of the law creating the zones, but a few who have become what is known as "outlaw" planters insist upon growing cotton in the forbidden area.

Much of the country is heavily timbered, roads are few and bad, and it was very hard to find these hidden fields. But with army aviators lent by the War Department the Department of Agriculture recently carried on a campaign which discovered seven fields in the forbidden district.

Trapped in the Bowels of the Earth

THERE are mines in war and mines in peace, and so the very microphones and geophones that located German diggers with great accuracy last year are now holding down peace jobs in American coal-mines. By means of these instruments sounds can be heard and located to a depth of one hundred and twenty feet. The microphone records air waves, and the geophone earth waves.

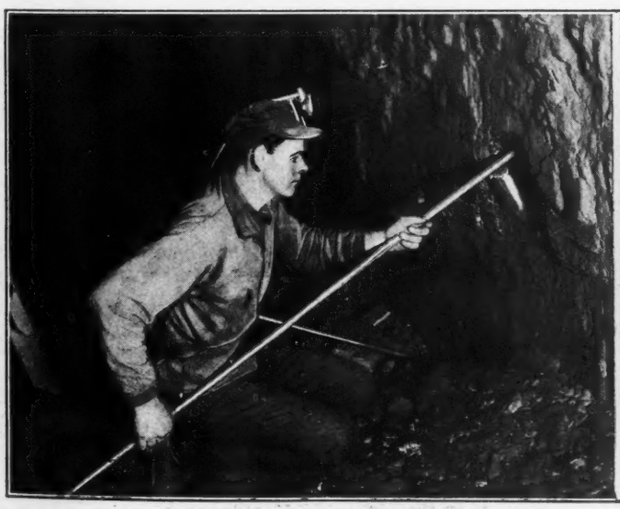
These two instruments are very much alike in the matter of construction. The receivers that fit over the ears of the listeners are very much like the ordinary telephone receivers in an electric circuit. Two diaphragms rest on the ground. The smallest change in sound waves, such as that produced by the hammering of a miner trapped in the earth below, alters the resistance in the circuit and hence the current. This causes the sound to be reproduced in the receivers.

Heretofore if an explosion occurred in a mine, entombing the miners, rescue work was done blindly. Of course, the searchers were familiar with every section of the mine, and so could guess as to where the men would barricade themselves in to escape the gases in the mine and to preserve the precious air.

Often the miners were entombed for days, as in the case of the Cherry mine disaster in 1907. Sometimes they were brought out in time, at other times too late. It was simply a question of sheer luck. If the searchers happened to strike the right spot the miners were saved; if not, they suffocated.

Now a miner need only hammer at the wall, and the listeners stationed above will know just where he is and direct the searchers to him. The pictures shown below were taken when the instruments were tested. The man hammering the wall with an iron bar played miner, and the other two men listened.

The miner had barely stood up and brushed the dust from his knees when his searchers found him.



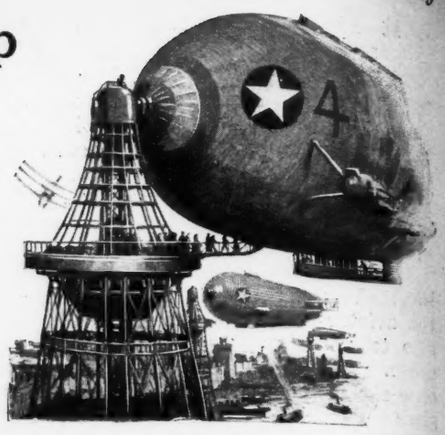
When the miner is trapped far below the surface of the earth, he need only hammer on the wall for the listeners above to locate him

One man has a microphone and the other a geophone, both of which record and locate the miner's tapping

Voyaging to Europe in an Airship

The skyscraper hitching-tower of the future

By Carl Dienstbach



BECAUSE the giant Zeppelin made no brilliant showing in its raids on England, the average man is apt to dismiss it with a wave of the hand, saying, "It's a failure." When he thinks of air transportation he thinks of airplanes.

It would profit him to read the report of Admiral Jellicoe on the great naval battle off Jutland, in which the Zeppelin showed how effective it can be as a naval scout, and to study the testimony recently given by Admiral Sims of our own navy before a Congressional Committee, pleading for the construction of titanic Zeppelins in this country. It would also profit that average man to ponder the fact that Great Britain now has a fleet of Zeppelins, and that one of them, in all likelihood, will be sent across the ocean to prove the practicability of transatlantic trips through the air.

The truth is that the great rigid dirigibles, to the development of which Count von Zeppelin devoted the last twenty years of his life, are the *Mauretanias* and *Leviathans* of the air. When it comes to voyaging from New York to London with something like the comfort and luxury of a fast ocean steamship, the business man of the future is more likely to buy his ticket for a transatlantic Zeppelin than for a transatlantic seaplane.

Zeppelin Difficult to Handle

Let us admit at once that it is more difficult to handle a Zeppelin, both on the ground and in the air, than a giant flying-machine. Half a dozen men at most are required to swing a huge Caproni or a Handley-Page airplane on the ground so that it heads in the proper direction. But when a Zeppelin comes down to be berthed in its 700-foot shed, a highly trained ground crew of from one hundred to two hundred men, each man knowing exactly what he has to do, must take the huge envelope in charge.

More Zeppelins have been wrecked on the ground than in the air. A fabric composed of a wonderful lacelike aluminum framing cannot withstand terrific collisions with the ground. And so, Zeppelin after Zeppelin was wrecked until a special ground-handling technique was evolved.

Now, a real ship of the air should no more require a shed than does a ship of the sea. It should be weather-proof. Indeed, this was Count von Zeppelin's main idea. In a sense, it is just as ridiculous to run a dirigible into a shed as it would be to house the *Mauretania* whenever she touches port.

Problem Solved by British

But what of the problem of docking this huge dirigible of the near future? There will be no problem—at least, not in the present sense. A shed for airships should be required only for repairs.

Before Europe was embroiled in the bloodiest of all conflicts the British showed us a way out. They built towers of steel and tethered their small non-rigid dirigibles to them by the nose. Thus moored at a height from the ground so great that they could not be dashed against the ground, the vessels swung like flags in the wind.

The idea may be carried out on a more grandiose scale when the transatlantic, weather-proof Zeppelin of the future arrives.

Imagine every important American city fringed with titanic steel towers that resemble the famous Eiffel Tower of Paris—hitching-posts to which Zeppelins are tied. They form integral parts of the steel framing of the skyscrapers that constitute their lower portions; for in the populous city of the future the utmost use must be made of every square inch of ground.

You go up, of course, in an elevator. You step out on a broad platform that surrounds the tower. A gang-plank runs from the platform to the moored Zeppelin, stretching away for eight hundred or even a thousand feet.

At the top of the tower is a curious semi-globular, vertical cup, gilded so that it flashes in the sun. Into this cup the nose of the Zeppelin is received and lashed to the tower.

Platform Swings with the Airship

The cup on top of the tower and the platform from which the gang-plank runs to the ship constitute a structure independent of the tower. The cup and the platform revolve together.

You can see at once what this means. As the Zeppelin, with its nose poked into the cup, is swung by the wind, just as an anchored ship swings with the current in a river, the platform swings with it. Even though the craft may be in the act of swinging in response to a passing gust, you step on board by way of the gang-plank just as you would climb the stairs lowered down the sides of a ship anchored in a stream.

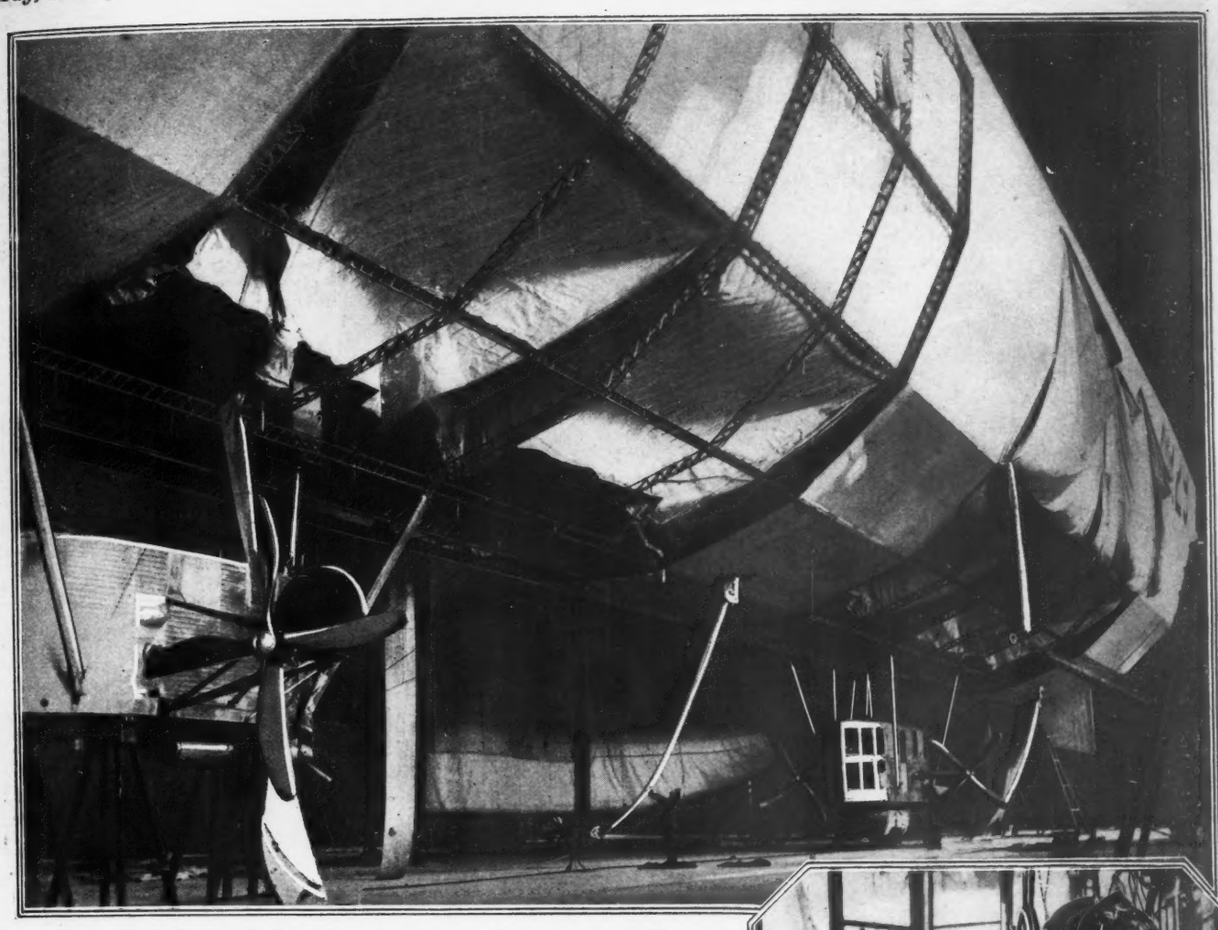
An aeronautical engineer, familiar with the vagaries of gas, realizes that it is not enough to hitch a Zeppelin to a high tower and leave the craft to itself. Gas and ballast must be controlled at anchor as well as in the air. But that is no difficult matter. Water ballast can be pumped through pipes wherever it may be needed, and gas can be conveyed in a similar manner. Hence, we must expect to find pumps on the towers so that an anchored vessel may be trimmed. Indeed, the pumps can be automatic. As for pipes, a part of the aluminum framing of the envelope may be used without adding an ounce of weight to the vessel.

When It Reaches New York

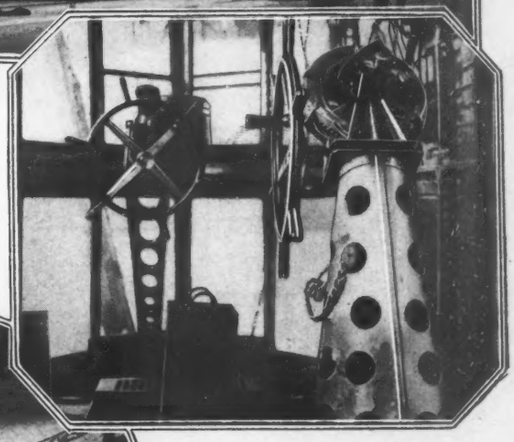
But what of currents of wind? They are almost negligible at the top of a lofty tower. But if they should occasionally make themselves manifest, and that so rapidly that it is impossible to shift ballast or gas quickly enough, then the vessel's own elevating rudders can be used. Oh, the crew must always be on duty, you argue? Not at all. The elevating rudders can be operated automatically. A mercury level will switch electric servomotors on or off.

What a sight it will be when a transatlantic Zeppelin arrives at New York and heads for its tower, a long, beautifully modeled, slim cylinder. Down she slides. See, she comes up slowly into the lee of the tower and against the wind. Thus she uses the wind as a kind of brake. She must fight it with her own engines, and fight it she does. By nicely regulating his own speed, the commander literally crawls up to the tower. Ah, a line has been thrown out and caught by the Zeppelin. The rest is easy.

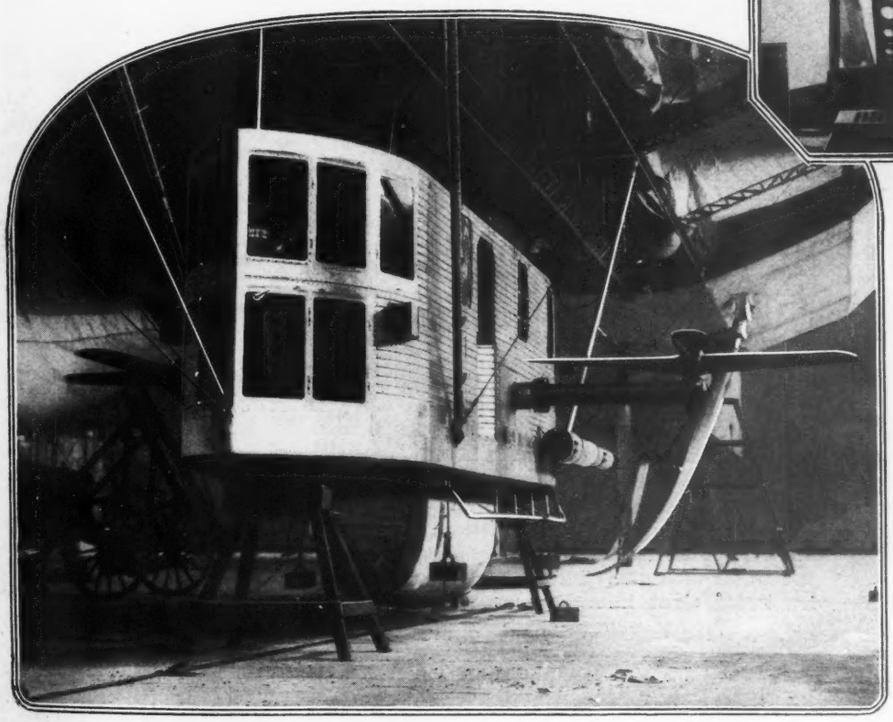
Curiously seamanlike, too, will be the airship's departure for Europe. She casts off. She drifts away with the wind, and sinks a little with the stern down (a kind of "tail slide" in airplane parlance), until the propellers reverse the motion past the tower. Then she goes up, up, up into the air, and away to distant London, where her passengers will breakfast day after tomorrow.



Here she is in her shed—a giant British Zeppelin. Will the rigid dirigible of the future be thus housed whenever she finishes a voyage? We doubt it. It is very likely that in the future sheds will be used only for purposes of overhauling and repairing. This ship is the R-33, the largest of British Zeppelins, which has fuel capacity and engine power enough to cross the Atlantic



Just like the bridge of an ocean steamer, you say. And you are right. All the navigating instruments and appliances of the *Mauretania* are found on board a Zeppelin, with a few more (such as height indicators) that the captain of the *Mauretania* never needs



The engines are inclosed in separate cars, as this picture shows. When helium instead of highly explosive hydrogen is used to inflate the bags in the envelope above, it will be possible to put the engines right in the hull and thus give the craft cleaner lines

London to New York by Air: Across the Atlantic

By C. A. Oldroyd, Correspondent of the

[*Mr. Dienstbach wrote the preceding article for* POPULAR SCIENCE MONTHLY *before we received the following contribution from our British correspondent. Since the project of Messrs. Vickers is soon to be realized, we thought it well to present their construction of a Zeppelin mooring-tower side by side with Mr. Dienstbach's. As a matter of fact, Mr. Dienstbach proposed the mooring-tower fully fifteen years ago, when Zeppelin after Zeppelin was wrecked on the ground in high winds.—Editor.*]

GREAT BRITAIN has been making plans to institute a regular transatlantic airship passenger service between London and New York. Soon you will book your passage to London by air-liner and cut your time of crossing in half. Seasickness will be a thing unknown. You have ocean-liner comforts. When you are hungry you will walk into a well supplied restaurant. Luxurious berths invite you at bedtime.

The designers of these giant dirigibles are Messrs. Vickers, Ltd., the well known British armament-makers.

The air-liner proposed will have a length of eight hundred feet and a diameter of one hundred feet. It will surpass any German Zeppelin in size as well as in speed. The hull outline will be a perfect continuous streamline shape, with no external projections save the six cars carrying the propelling machinery and the stabilizing and steering planes near the tail of the ship. It will carry one hundred passengers and a crew of nineteen.

The passenger accommodation will be on top of the airship, for here no vibration due to the engines will be felt. The crew will be accommodated in the keel of the ship.

This internal keel runs the whole length of the ship, and an elevator connects the keel with the passengers'

in Two Days in an 800-Foot British Zeppelin

Popular Science Monthly in Great Britain

quarters. A shelter-deck, fire-proof smoking-room, and observation saloon will be provided.

Six engines, giving a total propelling horsepower of 3,500, are provided in the six cars to drive the ship at a speed of seventy-five miles an hour.

But building the airship alone is only half the problem. A shed capable of housing two giant airships costs about two million dollars, while the complete air-liner would cost less than the shed. Recognizing that the shed will have to be eliminated if commercial airships are to become a fact, Messrs. Vickers set to work and perfected a mooring-gear for airships.

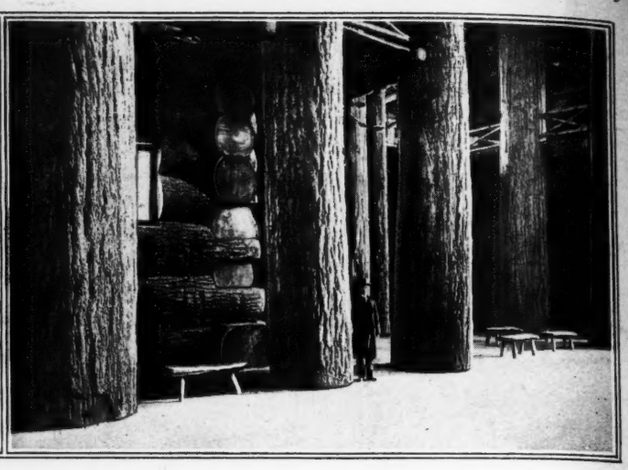
By this means the ship can be moored to a mooring-mast and ride out the severest gales in perfect safety. This mast allows the ship to swing in every direction while held firmly. The ship can be released instantaneously when desired. The mast is about one hundred and fifty feet high. Four strong steel cables are secured to the masthead at one end and to deep concrete foundations at the other.

The mast itself is of square cross-section, and an elevator travels inside. Gas, water, oil, and gasoline supply-pipes are also carried inside the mast.

When the elevator reaches the revolving top of the mooring-mast the passengers enter the ship through the bow immediately below the mooring-gear. A flexible, covered corridor, similar to the connection between Pullman cars, connects ship and mast.

A second elevator takes the passengers from the keel to the top of the ship, while a small runway conveys food, mail, and cargo to the store-rooms.

The passenger rate from London to New York is £115 ($575), while mails cost only fifteen cents an ounce.



Oregon's Log-Cabin Monument to Its Trees

THE trees of Oregon pay taxes to the State and support four fifths of the inhabitants. Both the State and the people have felt most grateful, but knew not how to express their appreciation. Trees are hard things to thank. The Portland Chamber of Commerce at last decided on a monument—not a marble tree on a marble base with a tender inscription on its bark, but an immense log cabin made of the trees themselves.

It contains more than a million feet of lumber, and it is the largest log cabin in existence. There are five huge tree pillars at the front entrance and many more around at the back door. Its great size can be appreciated by comparing it with the small man leaning against one of the pillars in the picture on the right above.

One fifth of the standing timber in the United States is in Oregon, which State stands fourth in timber production in this country.

If Oregon's merchantable timber, representing more than 403,000,000 feet, were sawed into lumber, it would require 430 years' work for 30 sawmills, each sawing 100,000 feet of lumber every working day of the year, and 336,111 trains of 60 cars each, making a continuous train of lumber, reaching nearly seven times around the earth at the equator. The value of this is not less than $680,000,000, and when manufactured is equivalent to bringing into the State $6,822,500,000.

What's a German Helmet Worth?

IF you didn't get a chance to go over and get one yourself or didn't have a son or a friend to pick up a German top-piece for you, there is still a last opportunity left to win one while fighting for liberty and the Republic. You won't run the slightest risk, to be sure, nor have the glory of the fighting man. You'll have to fire a golden bullet in the Liberty Loan campaign, where every $10,000 bond purchaser will get a German helmet, one of the common or inverted-kettle variety, or perhaps a dressy *Pickelhaube*.

The instalment of bond-boosting Hun hats in our picture number 86,000. The Liberty Loan captains are hoping that they will have to ship more of the "tin hats" from France. The soldiers will tell you that it's a lot easier to buy one here than it was to go Fritz-hunting in Europe.

© International Film

This Carpenter Has No Arms or Legs

THE most tragic case of war is that in which a healthy, whole man enlists, fights, is wounded, and is sent back maimed—an arm gone, a leg gone, sometimes both, sometimes all. The world's sympathy does not repay him for his ability to do things.

If he persists he will be able to work, no matter how badly maimed; for look at the man above. With arms and legs gone, he is yet a first-class carpenter. With one arm stump and one leg stump he holds the saw, and with the other arm he holds the work.

Learning to Play by Animal

BANGING ear-splitting discords out of twelve notes on a toy piano will be an unknown joy to the children of the future, for the child's piano is fast turning into an "educational toy."

Well-meaning educators have decided to use it and pictures of animals to teach children scales and to help them pick out such tunes as educators think proper.

A different animal is painted on each key; and in the music book the tunes are interpreted in terms of these animals.

The Japanese Way of Mailing Mail

A JAPANESE mail-box looks like a combined fire-hydrant and water-heater, and it is painted bright red. Without a doubt it is the most startling and substantial thing in that dainty country. But this is fitting, for mail is considered a serious matter by the Japanese government.

When the kimonoed gentleman in the picture below reaches the mail-box, he will turn the dial until the slot in it coincides with a slot in the box. He slips the letter in the slot and the dial swings back where it belongs. When the postman comes along he will take the mail through the door at the base of the column.

What London Is Doing with Its German Cannon

ALL the Krupp blood in this cannon is boiling at the undignified position forced upon it. In the first place it is in London, and in the second place it is turned almost upside down with its trail high in air. The same thing has happened to many other German guns, for cannon trails—particularly German ones—make excellent perches from which to view parades, and there are many parades in London today.

Besides these other indignities, this German trail is forced to look at returning victorious soldiers whom, not so long ago, its other end tried to kill.

Unfortunately, the American merchant marine has been too busy with other things to bring over any German cannon.

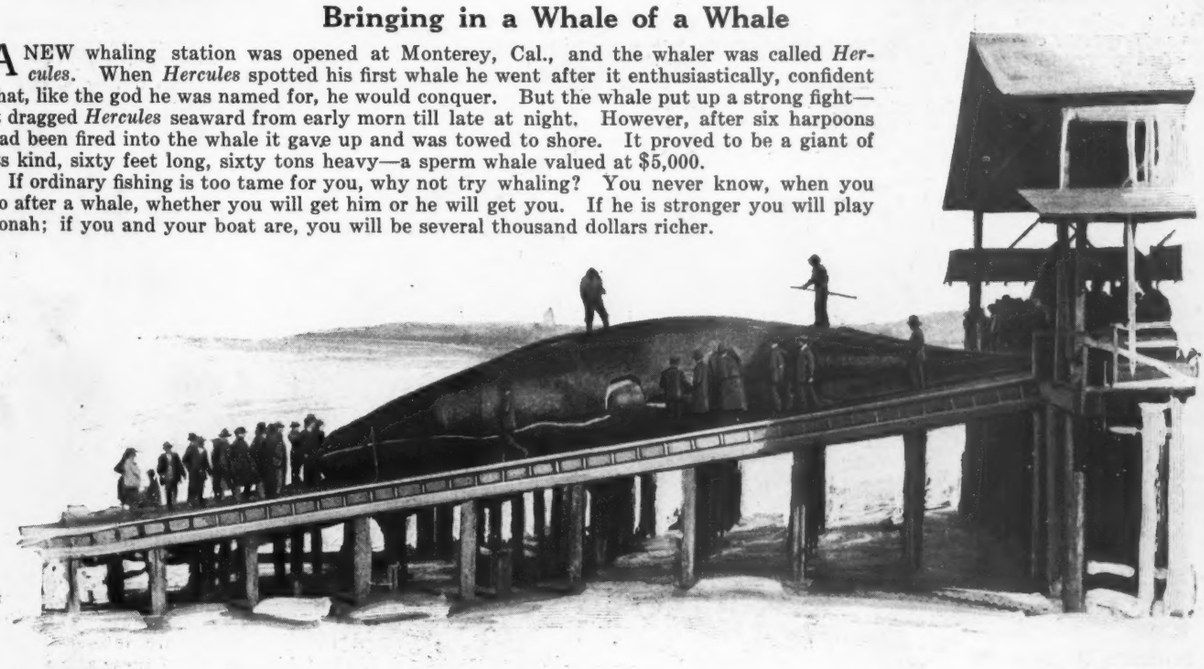
The Bees Love Him

STUNG? No, honey! Sounds like slang, but it is an exact statement of fact, since E. R. Root, the man who appears to be washing his face in bees, says that when bees are kept busy making honey they are too happy to sting anyone. Mr. Root is a bee expert who is known wherever hives and honey grow. To prove his peace pact with the bees he wears a hatful of them when he lectures on "how doth the—" He always says that in California, at least, the bee doth very nicely, thank you, because there flowers—the makings of honey—bloom all the year round, and the bee is kept busier, and therefore happier, than anywhere else.

Bringing in a Whale of a Whale

A NEW whaling station was opened at Monterey, Cal., and the whaler was called *Hercules*. When *Hercules* spotted his first whale he went after it enthusiastically, confident that, like the god he was named for, he would conquer. But the whale put up a strong fight—it dragged *Hercules* seaward from early morn till late at night. However, after six harpoons had been fired into the whale it gave up and was towed to shore. It proved to be a giant of its kind, sixty feet long, sixty tons heavy—a sperm whale valued at $5,000.

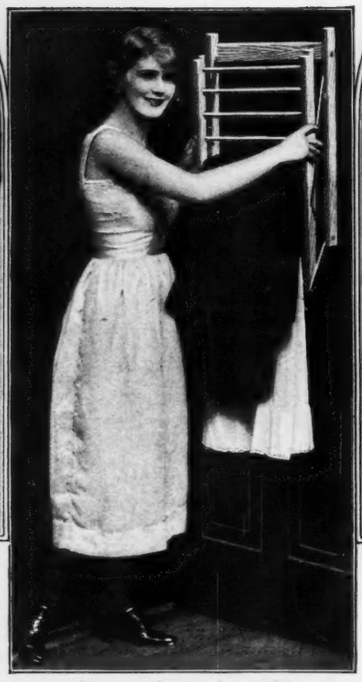
If ordinary fishing is too tame for you, why not try whaling? You never know, when you go after a whale, whether you will get him or he will get you. If he is stronger you will play Jonah; if you and your boat are, you will be several thousand dollars richer.



© International Film

Housekeeping Made Easy

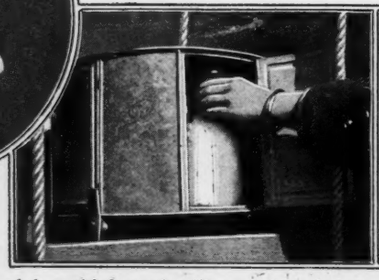
A shoe-shining kit that utilizes the cover of its container as a polisher. The box holds the cleaning materials compactly and is easily stowed away in a drawer



Hanging ten skirts, this adjustable folding rack is made to fit the inside of a closet door. When the skirts are in place the rack folds against the door, occupying very little space

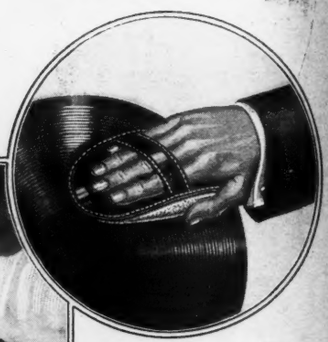
A combination dressing-stool and step-ladder for the bath-room has steps covered with rubber, while the wood is finished in a pleasing white enamel

This medicine-spoon has a spring cover easily lifted by pressure of the thumb when in use

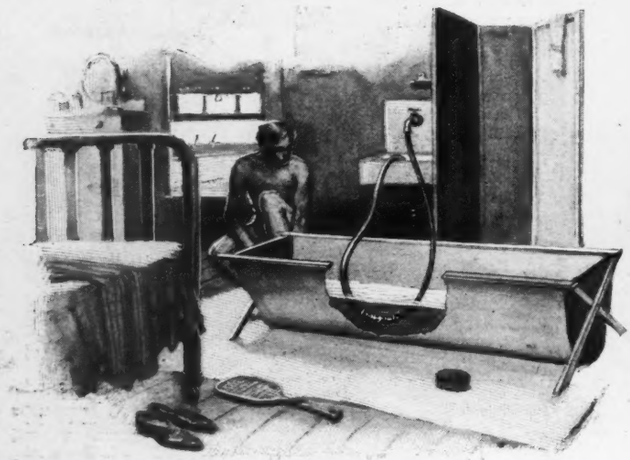


The revolving thief-proof milk-container has as many locked compartments as there are tenants, and is attached to the dumb-waiter

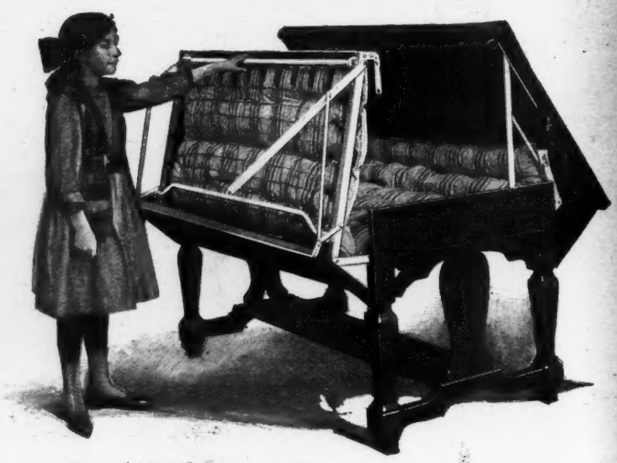
An ingenious dust-cloth, painted to resemble a "mammy's face," is a mitt that fits the hand; the cleaning is done by the woolly hair



A velvet-covered phonograph-record cleaner which enters into the record's tiny grooves

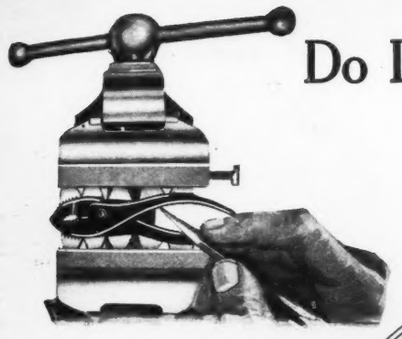


Perforations in the hose permit the pump operated by the faucet to suck the water from the tub into the washstand



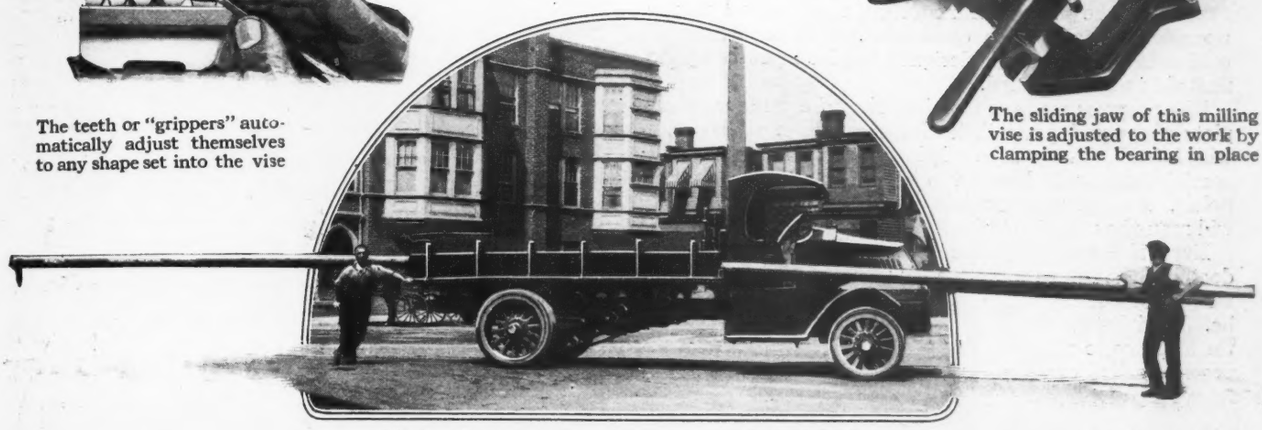
First as a handsome library table and then as a comfortable bed, this contrivance economizes space in apartment-houses

Do It with Tools and Machines

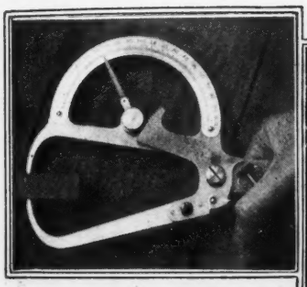


The teeth or "grippers" automatically adjust themselves to any shape set into the vise

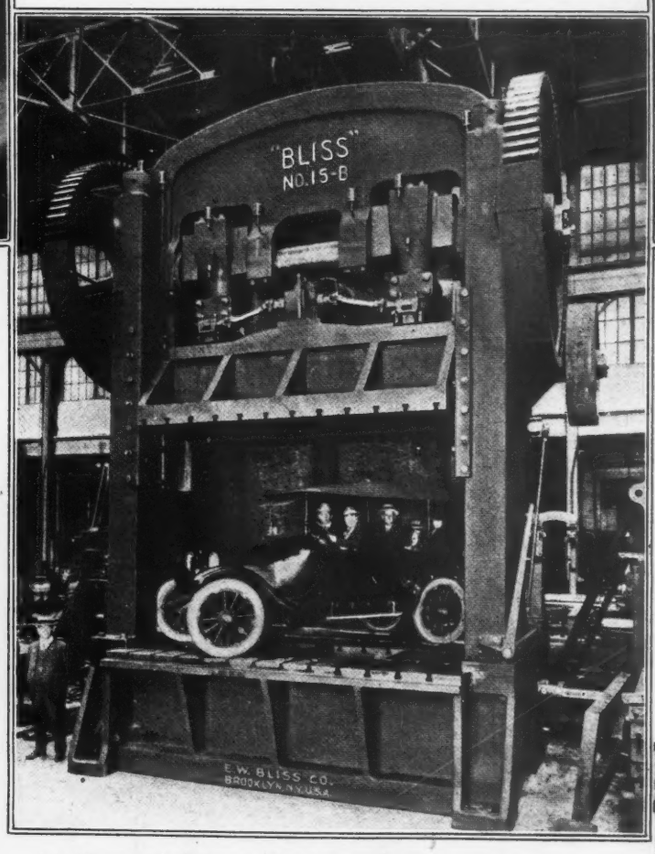
The sliding jaw of this milling vise is adjusted to the work by clamping the bearing in place



Used as lead screws on lathes for the United States Government, these 55-ft. forgings were easily and safely carried to their destination by a five-ton truck



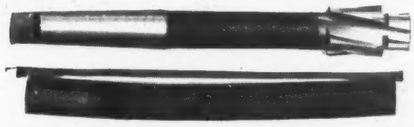
Indicating calipers are something that fills a long-felt want. It also combines both a rule and a magnifier



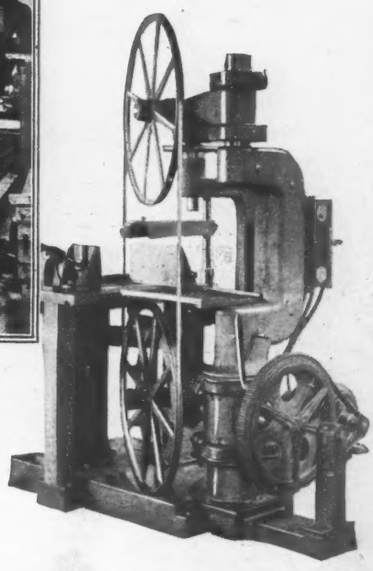
Presses that form and stamp automobile and railroad car parts into shape are ponderous machines, as may be seen from this picture

A handle that stays put is the boast of this vise. It may be moved to any position without varying the jaws

The amateur carpenter's tools will always be ready if he utilizes cigar-boxes thus



In welding high-speed steel to ordinary steel a saving is effected by using a shank of lower-priced material



Any boy can operate this new type of band-saw; it is practically fool-proof

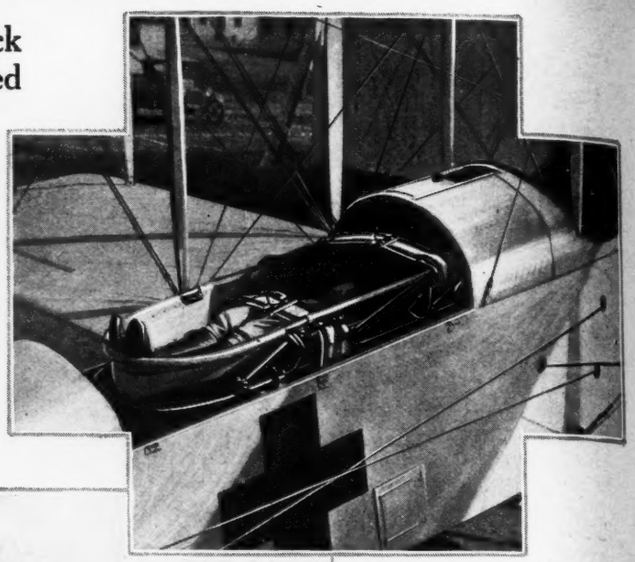
Bringing the Hospital to the Wounded by Air

Then, if a man is badly hurt, flying back with him in a stretcher or a bed

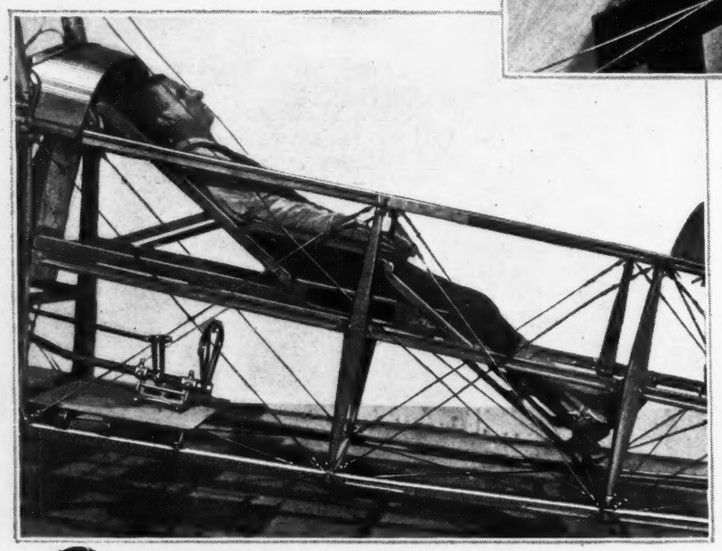
CARRYING the wounded from the field to a hospital by means of an airplane has proved so successful that the plan of transporting the hospital to the wounded has also been considered. Compact units of moderate size have been designed to give more complete first aid to the wounded.

The progress made so far gives rise to even more complete plans and possibilities for the future. The units will include X-ray sets. Minute compass needles of special design will locate the bits of shell or exploding boiler. A surgeon and radiologist, in addition to the pilot, will man the machine in its flights to the scene of action.

Even if there should be no more war, the airplane doctor of the future will have his work to perform, and a wonderful work it will be. Specialists will use the airplane to answer urgent calls coming from long distances.



The worst cases are carried back to the hospital in a comfortable bed held in its place in the airplane by rubber ropes



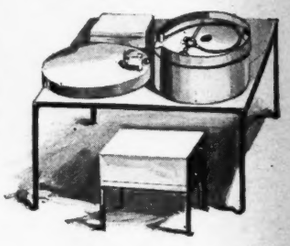
This is a regular hospital stretcher which fits in its place in the airplane

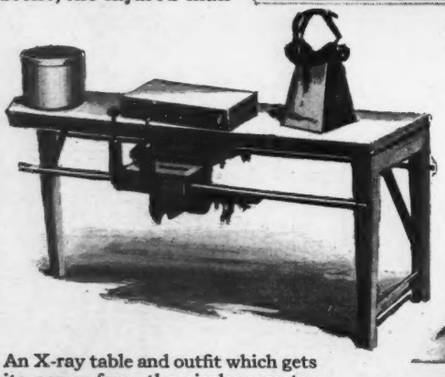
Power for X-Ray from Motor

The motor supplies power to a small dynamo that generates the necessary current for the X-ray apparatus. Lightness and compactness are the essential characteristics, so that the apparatus may be of a portable nature.

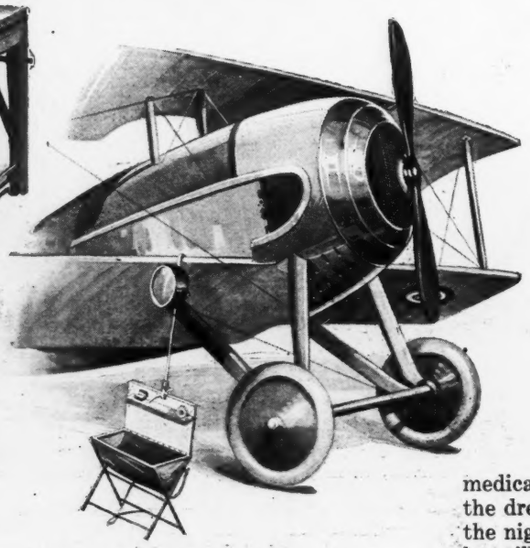
When a machine has arrived on the scene, the injured man may be taken into the X-ray compartment and examined at once without even removing clothing. If it seems undesirable to move the patient into the machine, the instruments can be removed and used outside or in any near-by hospital or other building. The machine, meanwhile, may return for additional supplies or more surgeons.

Out of small drawers—some of them in the airplane's sides—come a compact instrument stand, an instrument-box, and the necessary electric sterilizer





An X-ray table and outfit which gets its power from the airplane motor make first-aid surgery possible



The motor also heats water for the doctor's collapsible wash-stand. No detail has been overlooked in this wonderful air hospital

The physician's radius of action will be very greatly increased. He will be able to visit rural districts hitherto inaccessible. The country physician of general practice will be enabled to call into consultation the specialist living twenty or forty miles away.

The Doctor's Gig of the Future

Carrying the mail has already proved successful. Why not the transportation of physicians? The medical field is broadening beyond the dreams of a few years ago. Soon the night air of the quiet country hamlet will resound to the splutter of the airplane doctor's motor as he traverses the skies on his way to a patient.

This Farm-Hand Never Tires or Asks for Pay

Sit on the porch and watch the synmotor work

IT was not alive, apparently, and no human being seemed to be concealed about it, and yet the thing was seen cultivating a ten-acre farm in New Jersey. Down the rows of corn it went all alone, and never bruised a blade or chopped a root. It was uncanny to anyone who had never beheld such a sight before, and even to some who had.

It worked nights, too. Dimly outlined in the white moonlight, it could be seen threading its way with almost human intelligence and with mathematical precision, while the farmer slept peacefully in his near-by mansion and dreamed of waving corn-tassels. Around and around the field the thing moved, around a center which it continually approached. The corn had been planted in a spiral formation about a tall post capped with a circular drum or cask.

The furrows between the rows of dwarf corn are made by plows automatically steered

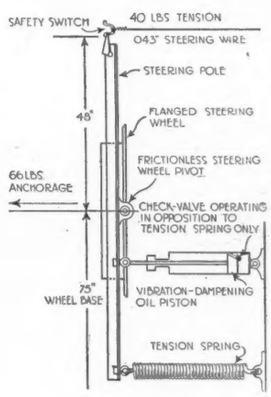
Close inspection reveals a thin wire extending to a central drum, around which the wire winds itself as the work of cultivating proceeds. That explains the spiral movement. The wire shortens itself by the same amount each trip around, and is used for steering the machine. Yes, it is a machine, after all. The wire, being perfectly tempered, cannot stretch, and an electro-coated surface protects it from rust. Its total weight is less than two pounds; yet a pull of six hundred pounds is required to break it.

The machine is a narrow tractor of special make, and it is called a "synmotor." The engine is a compact but very efficient gasoline type of about four horsepower. To the framework can be attached any of the usual implements for cultivating the land. Plowing, hoeing, harrowing, and the many other operations are performed in the spiral path as well as in the straight course. A gang-bar for the attachment of the implements may be used so that several rows may be cultivated at the same time.

When the synmotor is utilized on a large scale, the farm is divided into convenient ten-acre circles, each section being planted and cultivated separately. Any vacant spaces between adjacent circles can be utilized for fruit trees, buildings, or the like. For that matter, the intervening spaces can also be cultivated by merely disengaging the steering wire and utilizing the tractor in the customary manner.

For intensive farming and overlapping seasons, the accuracy of the synmotor in following a given track is of great advantage. The machine does not disturb the small plants, and it can work very closely to the rows. The working tools are spaced the exact distance between rows and do not swerve from the spiral course. Strawberries, peas and other vegetables can be cultivated with the synmotor,

With such a machine as this, the laziest man on earth can sit in the shade and fan himself while gasoline does his work.



Showing the works of the synmotor

This is the synmotor, the farming machine that does its work without an attendant; when it isn't cultivating the farm it can be connected to a churn to make butter

On the big drum the steering wire is wound, thus drawing the cultivator ever closer to the center

Finding Your Way Among the May Stars

With the help of the ancient peoples of the East, who were practical astronomers

By Ernest A. Hodgson, *of the Dominion Astronomical Observatory*

THE circular star map for May forms an interesting illustration for an outline of the origin and the value of the constellation groupings. These groups vary considerably in shape and size. The long-drawn-out constellation of Hydra lies side by side with the small, regular, and compact groups of Corvus, Crater, Antlia, and Canis Minor. The great constellations of Hercules, Ophiuchus, and Virgo are a striking contrast to the constellations of Lyra and Corona Borealis.

The longer one spends trying to fit the old mythological figures upon the star groups of their respective constellations, the more he is ready to believe the statement that the ancient peoples of the East were practical astronomers. Orion and the Great Bear seem almost possible, but tracing the outlines of a crab in Cancer or a giant in Hercules is quite beyond most people.

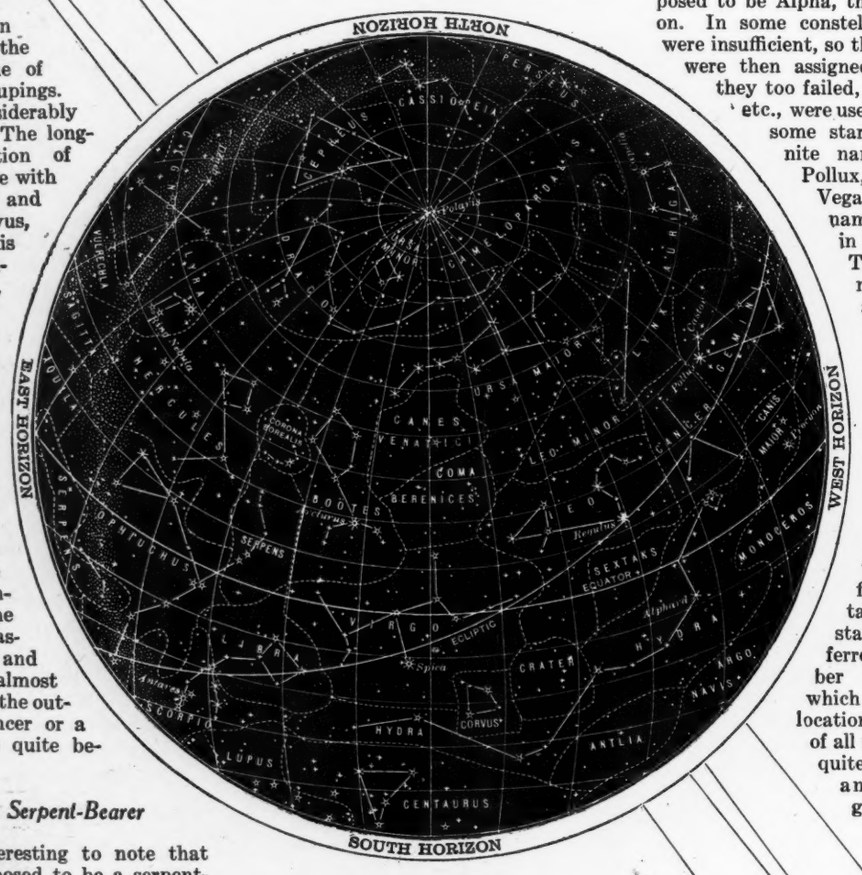
Ophiuchus, the Serpent-Bearer

It is perhaps interesting to note that Ophiuchus was supposed to be a serpent-bearer, holding a writhing snake, part of which appeared on either side of him. This accounts for the constellation of Serpens being in two parts. Lyra represented a lyre; Corona Borealis, a crown; Boötes, a hunter with his hunting dogs—Canes Venatici; while Corvus was supposed to indicate a raven; Crater, a cup; Sextans, a sextant; and Antlia, an air-pump.

These mythological figures served a good purpose in the early ages of astronomy, but confusion soon crept in, and no two atlases gave the figures exactly the same. Then a fresh start was made. The constellations were retained, but the stars were designated by the letters of the Greek alphabet. Generally speaking, the brightest star was supposed to be Alpha, the next Beta, and so on. In some constellations these letters were insufficient, so the letters *a*, *b*, *c*, etc., were then assigned in order. When they too failed, the numbers 1, 2, 3, etc., were used. In the meantime some stars had received definite names, as Castor and Pollux, Betelgeuse, Sirius, Vega, etc. The simple naming of the star was in their case sufficient. The others were designated by the letter and the constellation name.

New Stars Have Only Numbers

The arrival of the telescope soon made this method too unwieldy to name all the stars now visible. So the names that had become fixed in use were retained, but all new stars are simply referred to by their number in the catalogue, which gives their precise location. Thus the naming of all new stars nowadays is quite independent of the ancient constellation groups. The professional astronomer has no use for them any longer, since he is able to set on any re-



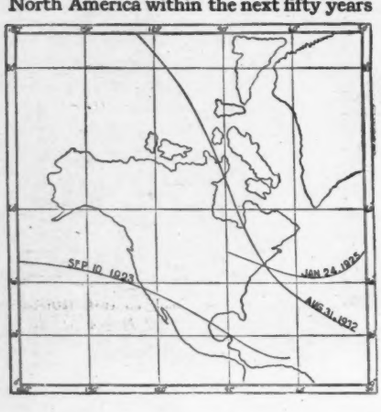
The Star Map for May

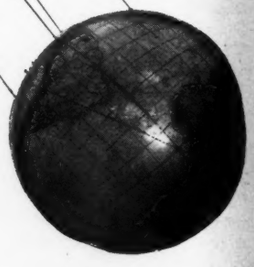
The map represents the appearance of the sky at the times listed below. It is specifically arranged for the latitude of New York, 40° N., but it is practicable for ten degrees on either side of this latitude.

April	7,	midnight
"	15,	11:30 P. M.
"	23,	11 "
"	30,	10:30 "
May	8,	10 "
"	15,	9:30 "
"	23,	9 "
"	31,	8:30 "
June	7,	8 "
"	15,	7:30 "
"	22,	7 "
"	30,	6:30 "
July	8,	6 "

The magnitudes are indicated on the map by stars of various kinds as follows: 0, open center; 1, eight points; 2, six points; 3, five points; 4, four points; 5 is indicated by a single point. All time in Eastern Standard (not summer).

These are the paths of totality for all the total solar eclipses which will be visible in North America within the next fifty years





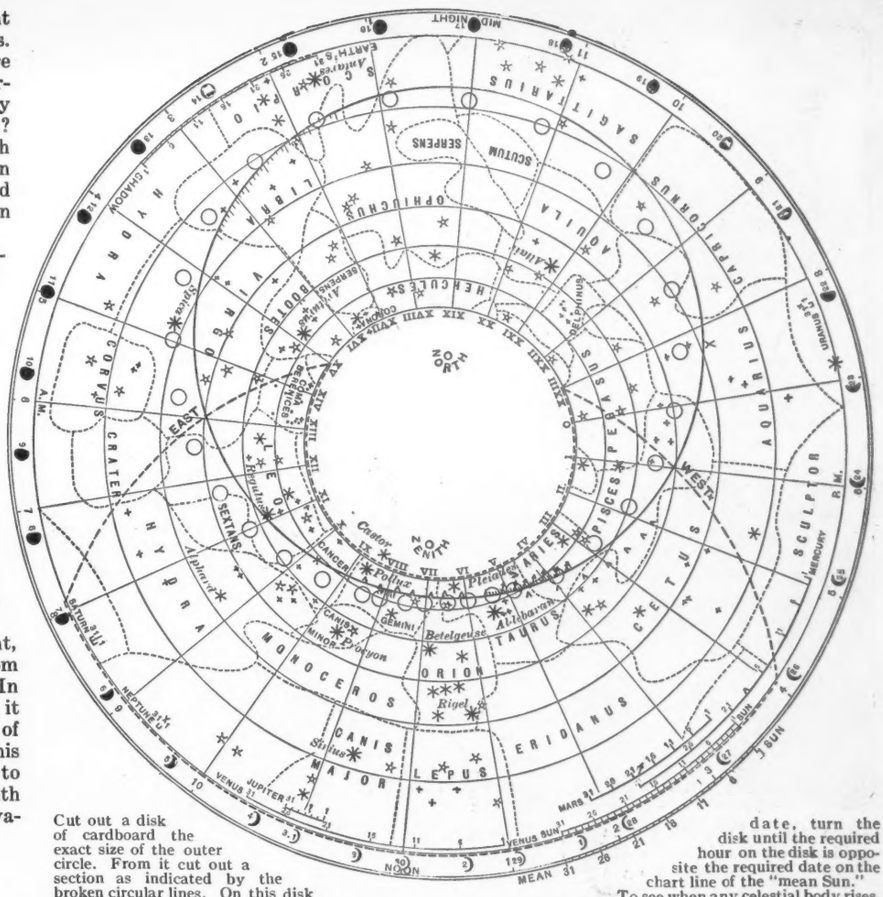
On May 28 the Moon crosses the ecliptic at a point already occupied by the Sun. The result is a solar eclipse. It will not be visible in North America. It will start off the western coast of South America at sunrise, cross the continent, the Atlantic Ocean, and Africa, ending at sunset off the eastern coast of Africa some five hours later

quired star by simply looking up its right ascension and declination in his catalogues.

So, as the constellation boundaries were not required for precise astronomical purposes, they have never been precisely located: why run a survey line in a desert? All that is necessary, in putting in such boundaries in an atlas, is to so trace them in that the few thousand stars that are named with respect to the constellations shall be in their proper places.

The constellations, however, enable amateurs and those who observe without instruments to make a report of any object they may discover by referring it to the near-by stars of a constellation group. Novae are very interesting objects, and astronomers are very anxious to get a chance to observe them at the very beginning of their appearance, before they have reached their maximum. But the professional astronomer, peering through his telescope or attending to his photographic plate, must confine his attention to an extremely small section of the sky, so that it is usually his telephone rather than his telescope that first notifies him of the advent of one of these celestial visitors.

All such discoveries are, on this continent, reported to Harvard, and forwarded from there to the observatories by telegraph. In the case of the last great Nova in Aquila, it is interesting to note the large numbers of amateurs who independently discovered this new star and reported it to Harvard or to Greenwich, enabling those provided with the necessary equipment to begin observations at once.



Cut out a disk of cardboard the exact size of the outer circle. From it cut out a section as indicated by the broken circular lines. On this disk mark the hours (Arabic numerals at edge), A. M., P. M., North, East, West, and Zenith. Run a glass-headed push-pin through the center of the disk, pinning it to the center of the map.

To see the section of sky visible at any time on any date, turn the disk until the required hour on the disk is opposite the required date on the chart line of the "mean Sun."

To see when any celestial body rises, sets, or reaches the meridian *on any date*, turn the disk so that the position of the body *for that date* is in the required position with respect to the horizons. Read off the hour opposite the position of the mean Sun *for that date*. The disk in use is shown below.

How to Find the May Planets

MAY will be favored with an unusually brilliant display of planets during the early evening hours. The three brightest, Jupiter, Saturn, and Venus, will all appear as evening stars, setting soon after the sun. In the early days of the month, and again toward the end, a crescent moon will add its beauty to the evening sky. During the early part of the month, too, the bright stars, Sirius, Procyon, Castor and Pollux, Regulus, Capella, and the bright constellation Orion, will all be visible to the west just after sunset. By the end Orion and Sirius will be too near the sun to be seen.

Jupiter and Saturn are in conjunction on the 25th, and the following conjunctions with the moon occur on the dates noted: Venus on the 2d, Jupiter on the 3d, Saturn on the 7th, and a second conjunction of Jupiter on the 31st. All these occur when the moon is new or nearly so.

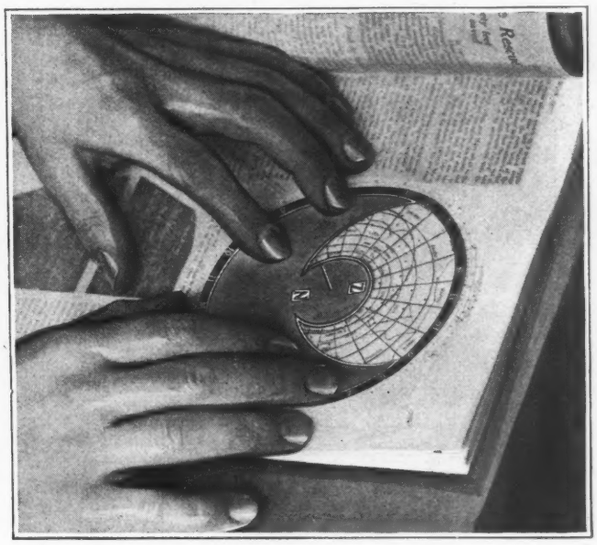
Mars will not be visible, being too near the sun. It is in conjunction with the sun on the 9th. Mercury is west of the sun, and so rises before it as a morning star. It reaches its greatest elongation, 26° 36′ west, on May 5. Uranus and Neptune are shown in position, but cannot be seen without optical aid.

Note the rapid apparent motion of Jupiter this month as compared with the previous months of this year.

The moon was new on April 30, at 0 h. 30 m. A. M. It reaches first quarter on the 6th at 6 h. 34 m. P. M. It is full on the 14th at 8 h. 01 m. P. M. May 22 at 5 h. 04 m. P. M. is the time of last quarter, and it becomes new again on May 29 at 8 h. 12 m. A. M. The centers of the circles show the moon's position at 9 P. M. on the date given.

The moon avoids the earth's shadow at full moon and so is not eclipsed. On May 28-9, however, it crosses the ecliptic at a point already occupied by the sun and so eclipses it. This eclipse will not be visible in North America.

The eclipse in May is total. It begins off the western coast of South America at the time of their sunrise, ending when the people on the east coast of Africa see it at their time of sunset, some five hours later.



Illustrating how to use the planet map according to the directions printed above

The POPULAR SCIENCE MONTHLY *is publishing every month an article like this by Mr. Hodgson. If you feel that these articles can be made more helpful, write to the editor. And if there are any questions that you would like to ask about stars, send them along.*

A Typewriter that Writes in Electric Letters

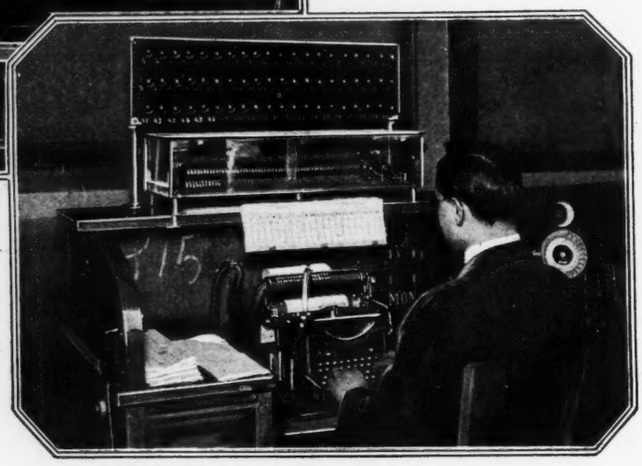
A HUGE electric bulletin-board atop a newspaper building in a mid-Western city flashes the latest news. The device is operated by a typewriter. The bulletins are typed on the machine in the usual way, while contacts underneath the keys control the apparatus that flashes the corresponding letters to the roof. As each key is struck, the corresponding letter appears in electric lights in its proper position on the big board. All the letters remain in position until the bulletin is completed. They are left standing a short while, and then the operator puts them out by pressing one key.

The sign itself lights up on both sides. Each side is divided into sixty units, arranged in three rows. Each unit contains an arrangement of twenty-one electric lights. Various combinations of these lights form any letter or numeral, as well as other characters.

Selection of the units is done automatically as the writing proceeds. This is made possible by an extra platen on the typewriter. In this platen are sixty silver plugs, arranged to correspond with the sixty units on the sign. A stylus rides over these plugs as the machine is operated, thus giving the desired connections.

Since the operator cannot see the result of his work from where he sits, a pilot-board is placed directly before him. This board has three rows of green-light bulbs, corresponding to the three rows of units. When he strikes a letter with the stylus resting on a certain plug on the platen, the corresponding letter appears on the display above, and automatically this causes the green light in the position corresponding to the unit and plug to burn.

The sign lights up on both sides. Each side is divided into sixty units, arranged in three rows, twenty-one lights to a unit. Various combinations of these lights form any letter or number



Bulletins are typed on the typewriter in the usual way, while contacts underneath the keys control the apparatus which flashes the corresponding letters to the roof

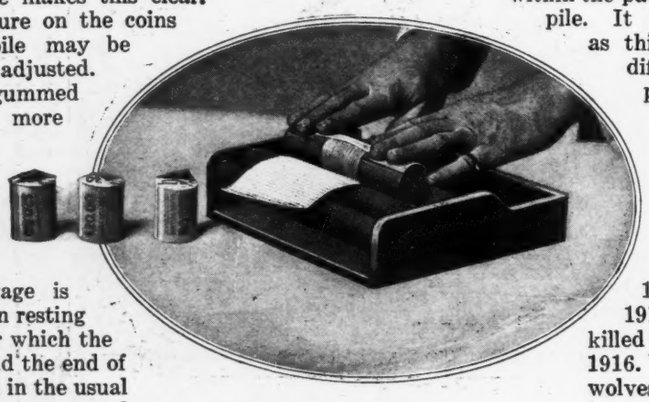
How Those Neat Little Coin Rolls Are Made

THERE is a new way of wrapping coins in those neat little packages that the banks supply. It does away with the necessity of holding the pile of coins in a vertical position, which is awkward and results in poor wrapping.

The coins rest on parallel rollers spaced slightly apart, but are held between two cylinders of wood upon the wrapper. The accompanying picture makes this clear. By exerting a slight pressure on the coins or on the rollers the pile may be rotated and the wrapper adjusted. One edge of the paper is gummed to make the package more secure.

When the package has assumed the form described, it is removed with the end blocks still protruding and acting as stoppers. The package is placed in a vertical position resting on one of the blocks, after which the upper block is removed and the end of the wrapper folded inward in the usual manner. The stack is then reversed and the process repeated at the other end. The wrapping is now complete.

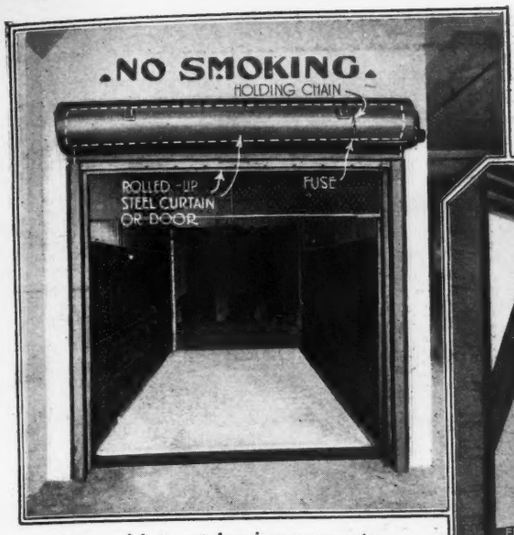
Different sets of the cylindrical blocks must be ready at hand for use with the different sizes of coins, for the diameters of the blocks must be the same as the coins. Grooves in the end blocks permit air circulation and make the removal easy. Without these grooves the attempted removal of an end block would create a partial vacuum within the package and tend to disarrange the pile. It is just such a simple expedient as this groove that often makes the difference between a good and a poor device.



The coins are wrapped by turning the stack while the end cylinders hold the coins together

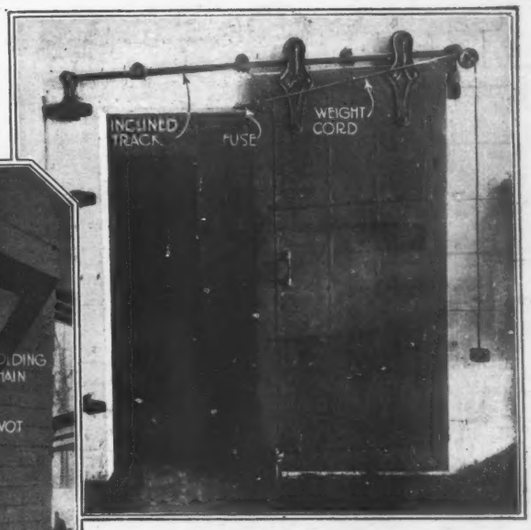
Snakes Take a Mean Advantage of the War

SNAKE bite caused 23,918 deaths in British India in 1917, nearly 300 more than in 1916. There were 2,176 persons killed by wild animals, 102 less than in 1916. Tigers got 1,009; leopards 339; wolves and bears, 280; elephants and hyenas, 89. Of the 456 set down to "other animals," 89 are assigned to pig, and 199 to crocodiles.



If you wish to get low insurance rates, you should protect your elevator with a door like this, which rolls down automatically when fire reaches it

In case of fire, this window closes automatically, shutting out the air without which no fire can burn



This door, mounted on rollers, is held open by a weight and a chain containing a fuse; in a fire the fuse melts, closing the door

Windows and Doors that Are Planned to Trap and Outwit Fire

DID you ever see a door or window that would shut itself in case a fire started in the room? If you did not, look at the accompanying three pictures. They show an ordinary door, an elevator door, and a window that are the latest things in modern fireproof warehouse construction. They work on the same principle as the water-sprinkler, which gushes out its water as soon as the temperature is sufficient to melt a lead fuse in the water-nozzle.

These pictures were taken in a Fort Worth, Texas, warehouse that has the lowest fire insurance rate in the whole State because every window, door, and elevator-shaft shuts itself, confining any fire to the room in which it starts.

The window-sash is made of steel and is pivoted at the sides at points below the middle, so that the window tends to shut itself when open, but is restrained from doing so by a small chain fastened to the bottom of the sash frame, then led through an eye at the top and finally fastened to a catch on the window-sill. A lead fuse, so made that it will melt at a certain temperature, is hooked to the chain at the point of attachment to the bottom of the window. As soon as the heat of the fire melts the fuse, the chain pulls away from the window and it slams shut, cutting off the air without which no fire can burn for want of oxygen.

While the window is closing itself, the door leading to the next room is also closing automatically, so that the fire is confined to one room.

Teaching a Horse to Pump Its Own Drinks

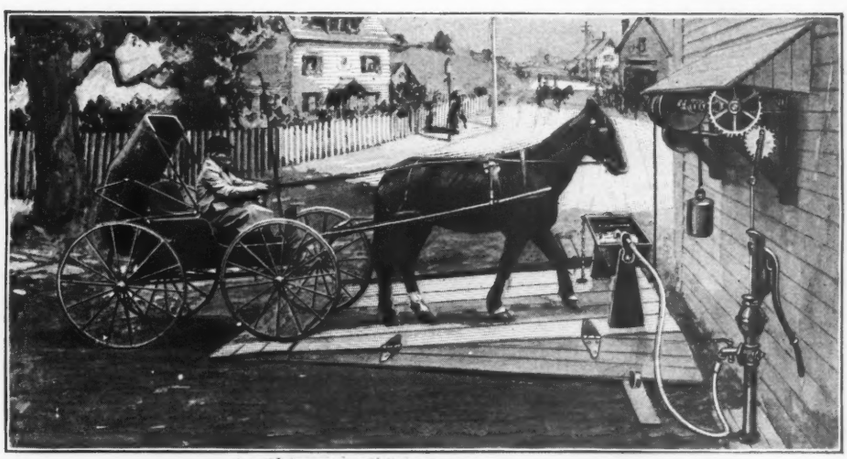
"WHOA, Napoleon!" the driver shouts, and the horse mounts a platform in front of a water-trough and proceeds to pump itself a drink.

As a matter of fact, any other animal of sufficient weight could do the same thing. The platform is hinged so as to descend from an inclined to a horizontal position beneath the weight of the horse, and the power thus made available is transmitted by a rope to the pulley of some shafting overhead. The revolution of this shafting operates the pump.

A hose connects the pump spout with a nozzle just above the trough. The trough is mounted upon uprights on the platform by means of projections at the ends, a construction that permits it to be automatically tilted and emptied when not in use.

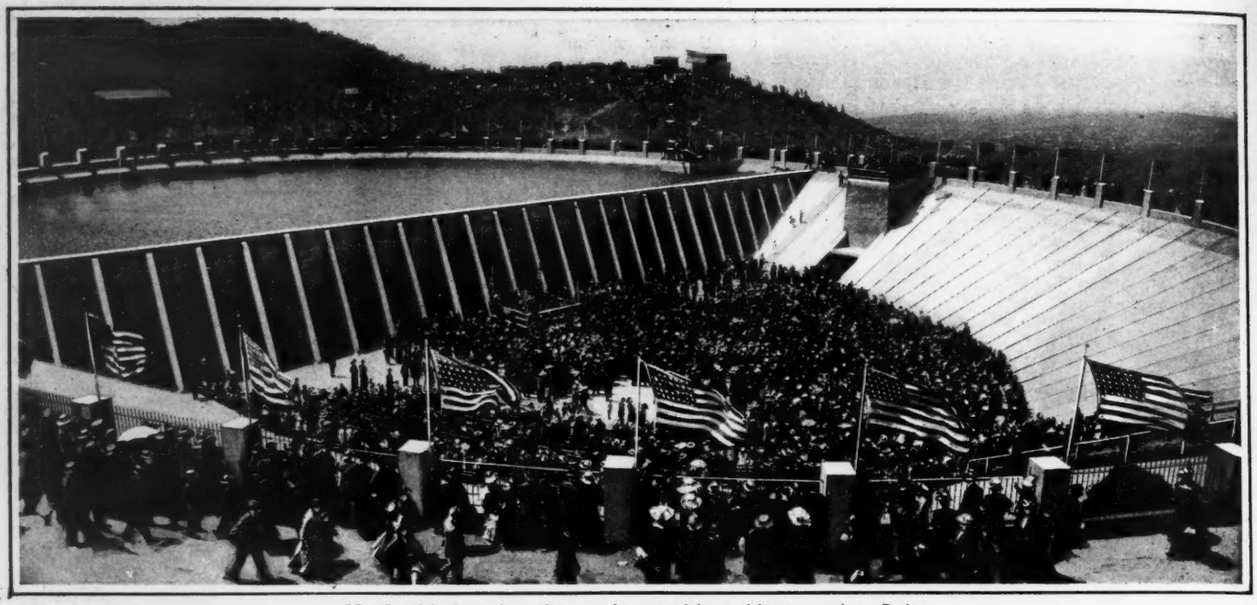
No motor is required. After the first impact of the horse's feet, the machinery is set in full motion and the operation is entirely automatic. The momentum of the shafting is increased by the effect of a heavy fly-wheel which gradually attains full speed and then expends its stored-up energy in the operation of the machinery.

When the horse has finished drinking and has backed off the platform, the latter is automatically raised to its former inclined position.



By merely walking upon this platform, a horse starts going a chain of machinery that results in pumping water into a trough

The Dam Confidence of the Californians



No flood is feared as the people crowd into this reservoir. It is built in sections so that it may be easily drained for cleaning

SCENE: The dedication of the Twin Peaks reservoir in San Francisco. One section of the reservoir had been drained, and into this the populace swarmed to listen to the speakers. Flags fluttered and bands played.

Only a wall of concrete separated the crowds from the towering waters in the adjoining section. Close beside the protecting dam the people stood, and little they thought of the pressure sustained. For the people of San Francisco had confidence in their engineers, and the assemblage was for the purpose of expressing that confidence.

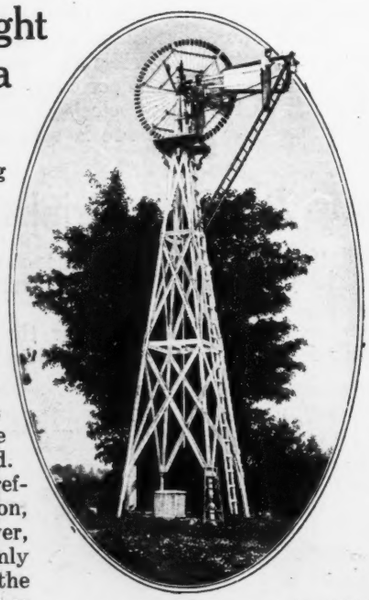
In the older forms of construction it was not always possible to clean the reservoir properly without emptying it completely. Dividing it into sections makes the cleansing operation one of very little difficulty.

There Is a Right Way to Paint a Windmill

"IT took nearly as long to paint the vane as it did to paint the rest of the windmill," remarked a painter a short time ago, "for we had to hoist up lumber and build a scaffold." Then he was shown the accompanying picture, which tells how the painting can be done without a scaffold.

A small ladder, preferably with an extension, is secured to the tower, and the upper end firmly lashed to the tail of the windmill. This relieves the weak structure of much of the weight of the painter and makes him feel safe. A man cannot work properly if he is in danger of taking a drop of forty feet at any moment.

So, with his mind at rest, he accomplishes his work in short order. When our picture was brought to the attention of a painting contractor engaged in the windmill field, he liked the idea so well that he applied it in his own business.



A small ladder lashed to the framing will save the time and expense of erecting a scaffold when painting

Plowing with a Trolley Car

AMID the jests of onlookers, plowing with a trolley car was tried out, not on a farm, but on the streets of San Francisco. The car was of special construction, and was provided with a derrick and six hundred feet of cable for drawing the plow.

Thus the earth was loosened sufficiently to make its removal an easy matter. The method proved itself far more rapid than that of the ordinary spade and pick methods, and its adoption on a wider scale has been seriously considered. Five men constitute a crew for the usual operations in excavating for new lines or renewing old trackage.

In extending trackage, a buffer is placed at the end of the line to prevent running off the track. The ground is then made ready and the cable let out to the necessary distance. The plow can be steadied by hand.

This plow is drawn by a cable from a trolley car designed for use in street-railway construction

If it hasn't this Red Woven Label

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(Trade Mark Reg. U.S. Pat. Off. and Foreign Countries)

It isn't B.V.D. *Underwear*

WE weave the cool B. V. D. Nainsook in our own mills especially equipped to make this fabric. The cotton used is particularly selected for its quality and strength. This insures to you, the wearer, that superiority and economy only obtainable in B. V. D. Underwear

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THE B. V. D. COMPANY
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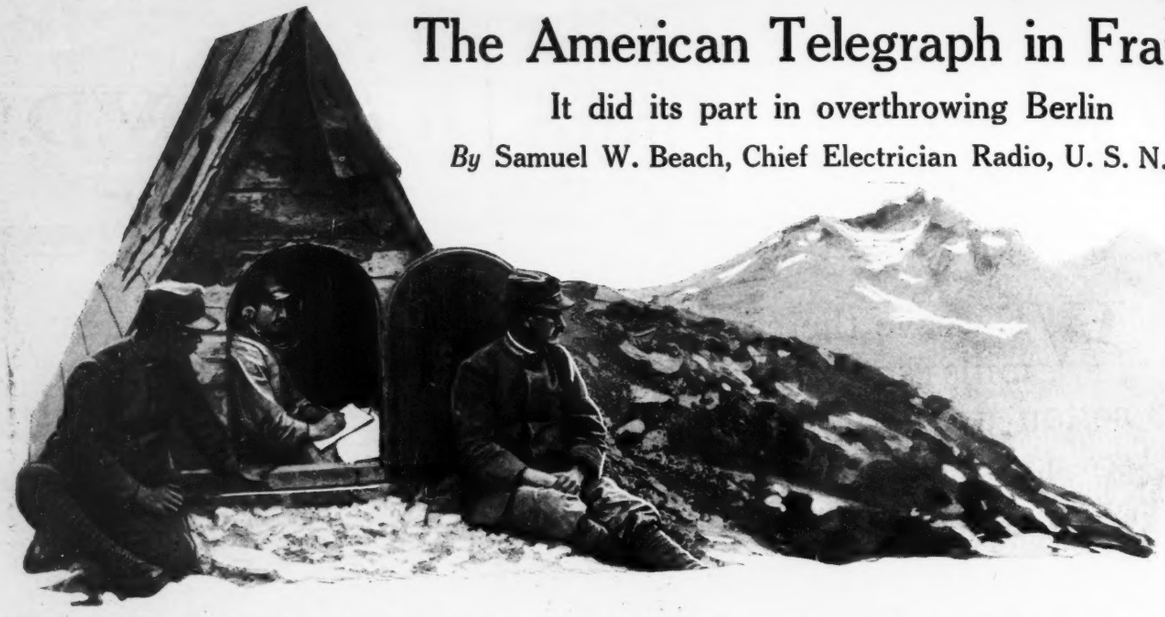
The American Telegraph in France

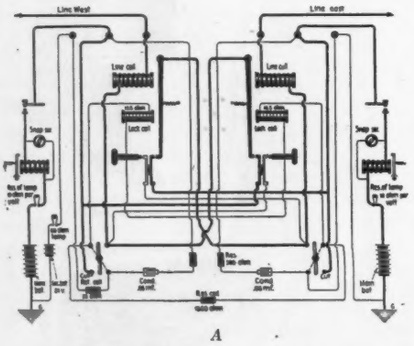
It did its part in overthrowing Berlin

By Samuel W. Beach, Chief Electrician Radio, U. S. N. R.



HAD the great war lasted one more year or even a few months longer than it did, America would have had completed and in operation a system of modern land-line telegraphs throughout the length and breadth of France not held by the Teutonic forces. This had to be done. The French government telegraphs, of the open-circuit variety, still universally employ the antique tape-recording machines such as we threw into the rubbish heap in the first days of the Civil War; "bluestone" and sal ammoniac cells have not yet been supplanted by the dynamo, nor does the typewriter figure in the game of the wires.

The slowness, sluggishness, and inefficiency of the system during hostilities was astounding. The British government railed and fumed and fussed about it. One high official even went so far as to complain publicly, and in the course of his remarks expressed no surprise that the "Big Berthas" still thundered at the trembling gates of Paris as they had thundered for four crimson years.



A

This wiring diagram shows the clean-cut method of actual connections

John Bull kicked, M. Poilu shrugged his shoulders; but the old tape machines continued to take their time in negotiating the most vital messages.

Entered then the Yankee. He fussed not; neither did he hesitate or postpone. His doughboys in khaki and his gobs in blue laid aside their shooting-irons, their gas-masks, and their military dignity, shouldered picks and shovels, strapped on pole-climbers, grasped comealongs, puckered their lips to the tune of "Dixie," "Yankee Doodle," or "Madelon," and made the fur fly along the turnpikes and rail highways of France from Brittany to the Hindenburg line, and from the shores of the English Channel to the frontiers of Spain.

Telegraph construction work is especially difficult in the western part of France, due to a rather thin soil in places, and solid rock beneath into which post-holes have to be blasted. But these boys, disdaining fatigue, snubbing holidays, scorning those rocks, carried the work ahead so rapidly that soon the main arteries were completed. Big, sturdy American Morsemen, skimmed from the cream of the profession in the homeland, oiled up their typewriters and their sending arms, American relays sputtered, American sounders clicked and clattered, and John Bull ceased complaining, while M. Poilu let his lower jaw fall in blank wonderment.

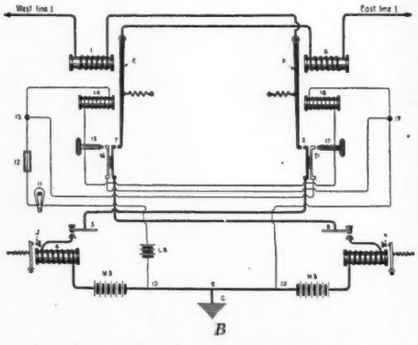
One of the main faults of the French telegraphs is the scarcity of apparatus for automatically repeating from one line into another. Apparently they prefer to do this by hand. Their circuits are necessarily shorter than ours, so that long-distance telegrams are relayed by hand a number of times while en route, and their transmission is delayed accordingly.

To defeat those well-nigh fatal delays, automatic telegraph repeaters were installed in the more important base offices by the A.E.F., the type of apparatus selected for the work being that now used almost exclusively by the American Telephone and Telegraph Company, but which are little known as yet by the telegraph fraternity at large. Diagram *A* shows the actual connections, and Diagram *B* shows the theory as simply and plainly as possible. It is the latter drawing that we shall follow in our description.

The heavy lines in the diagram indicate the routes of the main-line connections, while the thin lines trace the secondary circuits.

When at rest there are currents flowing through both the east and the west lines; their line coils, Nos. 1 and 6, are magnetized, holding their respective relay tongues to a close.

Should a distant office on the west line desire to "send," his first action is to open his key. Instantly line coil



B

The heavy lines indicate main-line routes, while the thin lines are secondary circuits

No. 1, and the local relay coil, No. 4, demagnetize, allowing their respective tongues to fall back.

The east line, entering the apparatus through line coil No. 6 and relay tongue *E*, becomes disconnected at contact No. 7, when that tongue falls back, so that the east line goes open in sympathy with the west. Now, when the east line thus opens, the line coil 6 becomes demagnetized, and were it not for the little secondary coil, No. 18, the relay tongue *F* would fall back, break-

The Standard Spark Plug of America

First Choice In Every Field

AC Spark Plugs have won the overwhelming preference of engineering experts and manufacturers in every branch of the automotive industry.

Aviation: At the outbreak of the war the United States Government invited the spark plug manufacturers of this country to submit plugs to be used in an aviation motor of 125 pounds compression.

The result of these tests was the adoption of AC Plugs for Liberty and Hispano-Suiza airplane motors.

At the time of the signing of the armistice we were producing 40,000 airplane plugs daily—more than the combined outputs of either France, England or other American makers.

These airplane plugs were of the same basic AC design used for years by the leading automobile, truck and tractor builders of this country.

Ordnance Tanks: Army engineers choose AC Plugs for a large number of the ordnance tanks built in this country for overseas service.

Army Trucks: Most of the trucks bought by the United States Government were AC-equipped. All of the standardized Government Class B trucks were equipped with AC's.

Motor Cars: For years AC Spark Plugs have been standard factory equipment on by far the majority of high grade passenger cars built in this country.

Trucks, Commercial: Most of the better known trucks are equipped regularly with AC plugs.

Tractors: A glance through the list of manufacturers below will show that many manufacturers of high grade farm tractors have expressed a decided preference for AC Spark Plugs.

To the spark plug buyer this concerted endorsement can mean but one thing. Engineering experts in every line, men who have the apparatus and scientific knowledge necessary for discriminating tests, believe absolutely that AC Spark Plugs are the best spark plugs.

That preference for AC's extends from the United States Government down.

You can make no mistake in following such example.

Champion Ignition Company, FLINT, *Michigan*

These manufacturers use AC Spark Plugs for factory equipment

Acme Trucks	Daniels'	Hatfield	Maytag	Peerless	Singer
Advance-Rumely Tractors	Davis	Haynes	McLaughlin (Canada)	Phianna	Smith Motor Wheel
Ahrens Fox Fire Trucks	Deere Tractors	Herschell-Spillman	Menominee Trucks	Pierce-Arrow	Standard Trucks
American-La France	Delco-Light	Hispano-Suiza	Midland Trucks	Pilot	Stearns-Knight
Anderson	Diamond T Trucks	Hudson	Moline-Knight	Premier	Sterling Motors
Apperson	Dodge Brothers	Hupmobile	Moreland Trucks	Reo	Sterling Trucks
Appleton Tractors	Dorris	Jackson	Nash	Riker Trucks	Stewart Trucks
Brockway Trucks	Dort	Jordan	National	Robinson Fire Trucks	Straubel Engines
Buffalo Motors	Dusenberg Motors	Jumbo Trucks	Nelson	Rock Falls	Stutz
Bugatti	Eagle Tractors	Kissel Kar	Nelson & LeMoon Trucks	Rowe Trucks	Titan Trucks
Buick	Essex	Klemm Trucks	Netco Trucks	Rutenber Motors	Tower Trucks
Cadillac	Federal Trucks	Kleiber Trucks	Northway	Samson Tractors	United States Motor Trucks
J. I. Case T. M. Co.	F-W-D Trucks	Knox Tractors	Oakland	Sandow Trucks	Vim Trucks
Chalmers	Gabriel Trucks	La Crosse Tractors	Old Reliable Trucks	Sanford	Ward La France Trucks
Chandler	Genco Light	Lalley-Light	Oldsmobile	Saxon	Westcott
Chevrolet	G. B. S. Motors	Liberty	Packard	Scripps-Booth	White
Chicago Trucks	G. M. G. Trucks	Liberty Aircraft Motors	Paige	Scripps Motors	Wilcox Trux
Cole	Gramm-Bernstein Trucks	Locomobile	Pan-American	Seagrave Fire Trucks	Wisconsin Motors
Continental Motors	Hall Trucks	Marmon	Paterson	Seneca	
Crane-Simplex	Harvey Trucks	Master Trucks	Patriot Trucks	Signal Trucks	

U. S. Pat. No. 1,135,727, April 13, 1915, U. S. Pat. No. 1,216,139, Feb. 13, 1917, Other Patents Pending.

ing circuit at contact No. 2. Should this actually occur, both contacts, No. 7 and No. 2, would be open, rendering it an impossibility for either the east or the west to restore the lines to a normal close again.

The tongue *F* must be kept closed while the west "sends," so that the latter may at all times enjoy an unbroken pathway through contact No. 2.

AB and *DC* are uprights of spring steel, each pair being connected by an insulating medium (indicated by diagonal lines in the diagram), so that they move in unison.

When the contact No. 7 is opened through the demagnetization of the coil No. 1, the springs *DC*, no longer held to the left by tongue *E*, open contact No. 16. At this instant, and before the tongue *F* has had time to sever connection No. 2, the current from local battery *LB*, ascending to contact No. 13, has had two pathways to choose. It may either travel laboriously through the coil No. 14, through 15 and 17 to coil 18, magnetize that coil in turn, and then meander onward through 19, 20, and 5 to the ground; or it may, and does, take the far easier road by disdaining coil No. 14 entirely, parting company at 13, and making for the ground through the one coil No. 18. The latter coil now being magnetized, the tongue *F* is held to a firm close at contact No. 2, even though there is no current flowing through line coil No. 6.

When the western operator closes his key to carve out his first signal, the contact No. 2 being unbroken, the entire apparatus falls back as it was in the beginning. The western current magnetizes coil No. 1, jumps through tongue *F* and contact No. 2, through key No. 3, magnetizes local relay No. 4, picks up more battery, and jumps to the ground from 5. When coil No. 1 is thus magnetized, tongue *E* closes contact No. 7, again closing the east line through key No. 8, local relay No. 9, adds the battery, and goes to the ground.

Should the east open to send to the west, the action heretofore described is simply reversed, the action of the secondary circuit being as follows:

The local current reaches 13, but is prevented from jumping to the ground through coil No. 18, because contact No. 21 opened when, due to the demagnetization of coil No. 6, the tongue *F* fell open. The local current then has no choice other than to continue onward from 13 into coil No. 14. This coil it magnetizes, holding tongue *E* to a close. As the tongue *E* is closed, the spring contact No. 16 is also closed, affording a pathway for the local current after it leaves the coil No. 14, through 15, 16, 19, 20, and 5, to the ground.

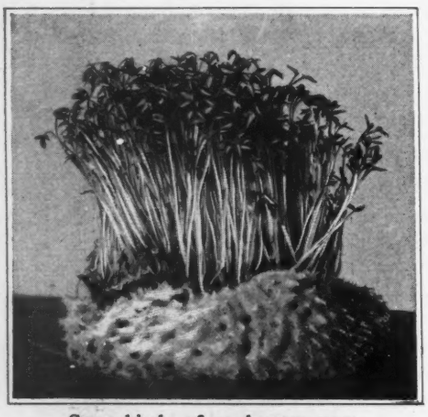
In practice there are switches, resistances, condensers, etc., as pictured in Diagram A, the various uses of which are obvious.

How to Make a Garden without Soil

If you can't go to the country make the country come to you

By Percy Collins

CITY dwellers who have an instinct for gardening are often heard to complain bitterly that they are denied all access to the soil, and are thus prevented from gratifying their horticultural tastes. Such people



Some kinds of seed grow very well in a moistened sponge

will be surprised to learn that there is such a thing as gardening without soil, as anyone who has a convenient shelf near a sunny window may easily prove.

A number of bulbous plants, of which the most familiar are hyacinths, will prosper in glass jars filled with water. Crocuses in great variety, not to mention many another charming flower, may be raised in the same way.

Several kinds of bulbs will blossom quite freely without either soil or water. Such is the case with the common colchicum and several of the fine amaryllis lilies, as well as the remarkable "monarch of the East," which throws up a huge and grotesque bloom often as much as two feet in height. All that is necessary is to place these bulbs in a saucer, or even on a shelf, in a good light, and nature will do the rest.

The gardener to whom soil is denied will soon discover that many kinds of seeds will sprout and grow almost anywhere, provided they are kept moist and in a fairly warm atmosphere.

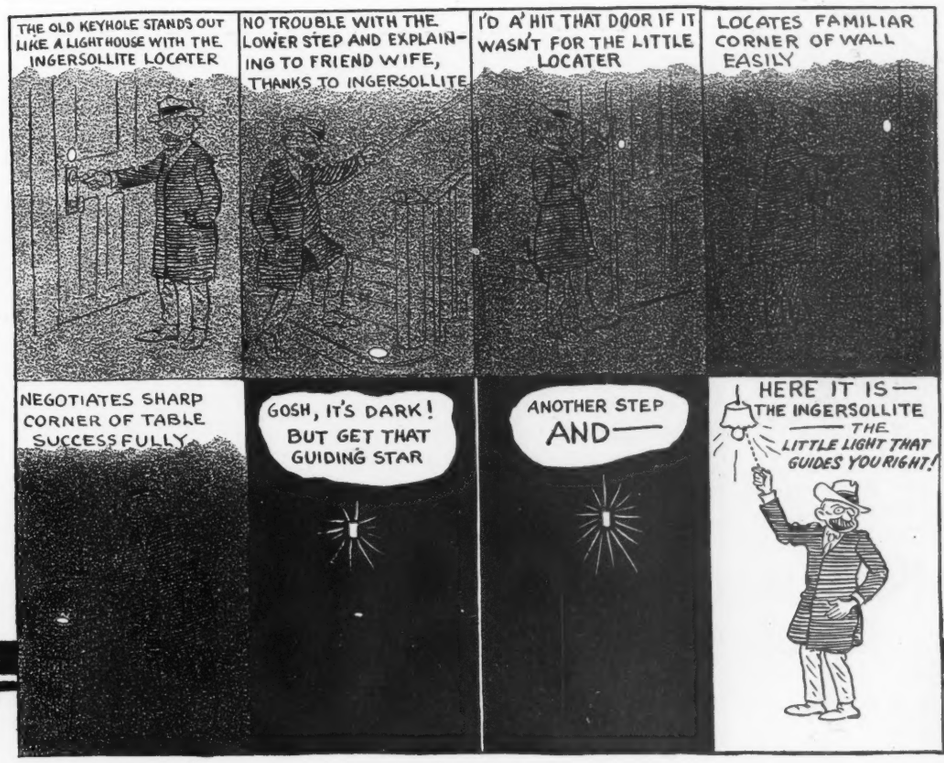
One plan is to wrap a piece of felt or flannel around a brick, which is then placed in a dish of water. The water soaks up constantly through the substance of the brick, and seeds scattered on the moist fabric will soon put forth shoots and roots, making an interesting novelty.

Instead of a brick an ordinary sponge soaked in water may be used; or hollow clay shapes, in the form of amusing heads or animals, may be purchased from stores that sell such novelties. Per-

A little bit of nature in a city flat brightens the days for those who have to stay in the hot city

Movie of a Man Arriving Home in the Dark

with apologies to Briggs


THE OLD KEYHOLE STANDS OUT LIKE A LIGHTHOUSE WITH THE INGERSOLLITE LOCATER
NO TROUBLE WITH THE LOWER STEP AND EXPLAINING TO FRIEND WIFE, THANKS TO INGERSOLLITE
I'D A' HIT THAT DOOR IF IT WASN'T FOR THE LITTLE LOCATER
LOCATES FAMILIAR CORNER OF WALL EASILY
NEGOTIATES SHARP CORNER OF TABLE SUCCESSFULLY
GOSH, IT'S DARK! BUT GET THAT GUIDING STAR
ANOTHER STEP AND—
HERE IT IS— THE INGERSOLLITE — THE LITTLE LIGHT THAT GUIDES YOU RIGHT!

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Ingersollite Locaters

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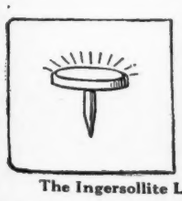
Because it glows in the dark, you don't grope around for the light—you just walk to it and turn it on!

Buy them today—and tonight you'll appreciate the handiness—the *utility*—of these little luminous guides!



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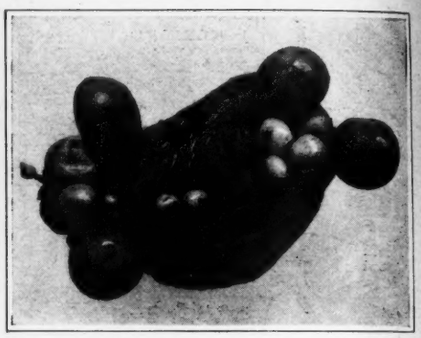
haps the best seeds to use for experiments of this kind are those of mustard and cress, especially as the young plants may be eaten as a salad.

Carrot ferns and moss trees are both interesting curiosities, easy to cultivate. Cut a couple of inches off the top of a big carrot, and scoop out the center of the piece so that a kind of cup is formed. Hang this in a good light by means of a wire, and keep the cup filled with water. Very soon pretty, fernlike leaves will sprout and turn upward, and in a short time the bit of carrot is transformed into a very decorative object.

Moss trees are simply cushion-shaped tufts of the moss that is common in fir woods, fixed by means of a long pin to the top of a stick. They can be easily made during a holiday



The lowly spud blossoms forth with a family of young tubers if kept in the dark

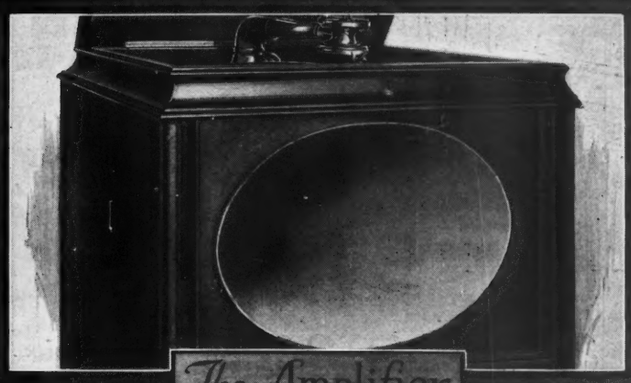
excursion; and if subsequently the moss is constantly wetted, it will flourish for months—even for years—in any room to which a reasonable amount of fresh air is admitted at regular intervals.

Trees may be raised from acorns, chestnuts, and the like, in bottles of water, and will continue to thrive for years if a little judicious root-pruning is practised from time to time. But in these and all other experiments with plants where standing water is used, one or two small bits of charcoal should be put into the vessel to keep the water sweet and pure.

Probably few persons know that excellent new potatoes can be raised from old ones by the simple process of shutting up the latter in a dry, dark box. The old tubers should be two years old to get the best results. Furthermore, it is essential that a really dry and really light-tight box be used. After a few weeks the experimenter will find, when he opens the box, that new potatoes are budding off from the old ones; and the process will continue as long as the old tubers have any living substance left in their shriveled skins.

There are several kinds of so-called "resurrection" plants that give good results when grown in a room. Probably the easiest of these to grow is a kind of moss, called selaginella, which is a native of Texas.

The BRUNSWICK
Method of Reproduction



The Amplifier

How We Banished Metallic Sounds

BEFORE The Brunswick Phonograph ever came to market, Brunswick executives were insistent upon a vital betterment: Reproduction.

We had been making phonograph cabinets for others for years. We had won top place during the past 74 years in the woodcrafting art. To stake our reputation on a Brunswick Phonograph was a momentous undertaking.

And so tone reproduction was studied for months. We tried every known method, the ones then accepted as supreme.

But every phonograph we ever heard in all our tests had good tones and bad tones, alternating in annoying frequence.

Higher Standards

Our tasks was to do away with the so-called metallic sounds. These, we found came from metallic construction. Tone waves must vibrate to attain their volume. And so, as a superlative feature of the Brunswick Method of Reproduction, we evolved the scientific Brunswick Amplifier under our own patents. It is built entirely of moulded wood.

This achievement, all acknowledge, is one of the great steps in the progress of phonographic art. It brings out tones hitherto lost. It banishes the raucous.

Another amazing advancement is the Ultona, our own all-record player—in-built, not an attachment. This reproducer, at a turn of the hand, presents to each make of record the proper needle and diaphragm. Each record is played at its best.

The Brunswick Method of Reproduction is one of the greatest triumphs of The House of Brunswick since its establishment in 1845.

Hear—Then Judge

You owe it to yourself and to your family, as you decide upon *which* phonograph, to become acquainted with The Brunswick. In your town there is a Brunswick Dealer who will be glad to play this super-phonograph for you.

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GENERAL OFFICES: CHICAGO and NEW YORK

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The Brunswick

Built From a Woman's Viewpoint

Why is it that women who know prefer the Western Electric Vacuum Cleaner? It is because this machine is constructed on principles which a woman instantly recognizes as correct.

She knows, for instance, that brushing is needed for many kinds of cleaning; that threads, hair and lint imbedded in a rug cannot be taken up by suction alone, but must first be loosened by a brush. She knows, too, that a carpet tracked with mud cannot be satisfactorily cleaned unless it is brushed before the suction is applied. She knows that there are many times, too, when a brush should not be used, and that a brush might be operated in a vacuum cleaner at a speed so fast that it is damaging to the rug. All of these conditions have been provided for in the

Western Electric Vacuum Cleaner

A brush was built into it—and you can operate the brush or not as you need it simply by turning it on or off. When the brush runs, it is not at the high speed of the motor, for the speed is slowed down by a worm gear. By this means we have combined a motor, creating a powerful suction, with a brush so regulated that it will be efficient yet gentle.

These features account for the immediate popularity of the Western Electric Vacuum Cleaner—the demand for it, since its introduction last fall, has made necessary an increase of more than 500 per cent. in our manufacturing estimates.

Mail coupon to nearest house for Booklet No. 84AT, telling all about this new cleaner.

WESTERN ELECTRIC COMPANY
INCORPORATED
New York Chicago
Kansas City San Francisco

Other Distributing Houses in Principal Cities

WESTERN ELECTRIC CO., Inc.

Gentlemen: Please send me Booklet No. 84AT, describing the new Western Electric No. 12 Vacuum Cleaner.

NAME

ADDRESS

Turning a Tree-Stump into an Outdoor Table

THE stump of a tree that has been cut down will serve as support for an outdoor table. Four-by-four in. scantlings of suitable length are sunk flush with the top of the stump, crossing each other at right angles. From each of the four angles of these four-by-fours, two-by-twos extend outward. It is as if eight spokes of a

A permanent picnic camp may be made from discarded tree trunks

wheel extended outward from the center of the stump.

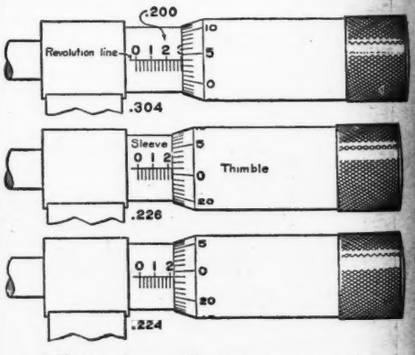
Boards nailed on the top complete this eight-sided table. Eighteen-inch sections sawed from the trunk of the tree serve as seats.—C. L. MELLER.

You Can Learn How to Read a Micrometer

REMEMBER that the micrometer divides the inch into one thousand parts.

The edge of the outer thimble is marked in twenty-five divisions. Rotating the thimble through one division advances the spindle .001 in.

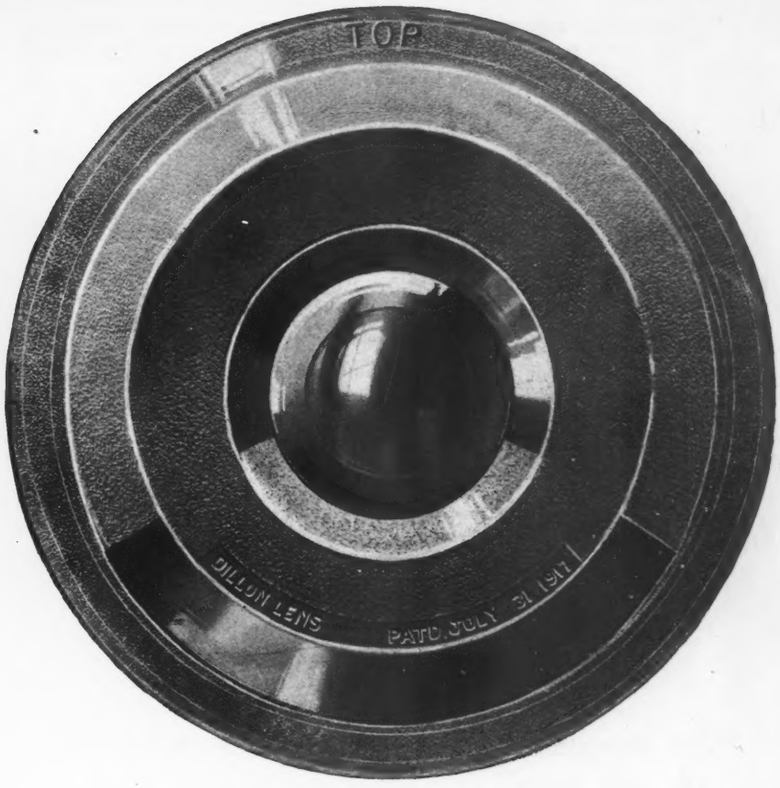
The number of rotations of the thimble from zero is counted on the



Micrometer-reading comes easy after a careful study of these instructions

inner sleeve by divisions. Every fourth of these divisions—four revolutions of the outer thimble—measures .100 in. Forty revolutions measure the full inch. Every full revolution of this thimble advances the spindle .025.

A little study of the illustrations will make the operation of micrometer-reading quite clear. Speed in reading comes only with practice—and a very little practice should enable the operator to read his micrometer almost at a glance.



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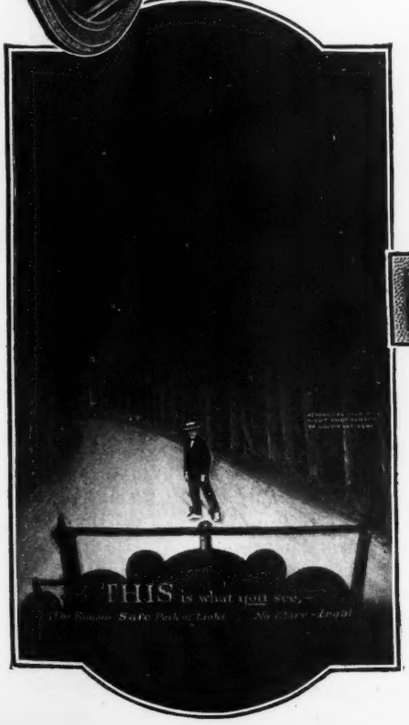
Any Size
Anywhere in U.S.A.



"They Give the Clearest and Most Penetrating Light I Have Ever Driven Behind"—

That is what Dr. B. H. Carter of Meriden, Conn., says about the Dillon Multi-Vision Lens.

It is the universal verdict.

Everywhere, in all parts of the country, wherever automobile headlights are discussed, the Dillon Lens is spoken of in terms of appreciation.

No other lens ever met with such spontaneous and unqualified approval from so many motorists.

You never hear an owner speak indifferently about his Dillon Lens. You never hear him damn it by half praise.

This nation-wide acceptance of the Dillon Lens can be interpreted in only one way. Such a remarkable condition could not be "created" or brought about save through and by the superior performance of the lens itself.

If you have never driven behind the Dillon Lens, do so at your earliest opportunity. The experience will give you a new idea of headlight efficiency and will serve to add your voice to the chorus of Dillon praise that is ascending in ever increasing volume from one end of the country to the other.

The Dillon Lens gives a big, glareless light, almost double the usual area of illumination. A light that leaps straight out at both sides, down in front and far ahead. The whole roadway is illuminated so that you can see clearly just where you are going and what dangers, if any, confront you.

This big, safe light gives you confidence as you sit at the wheel and minimizes to a marked degree the glare from the headlights of passing cars.

The Dillon Lens is legal in all states and fully guaranteed. Equip your car today. Then take ten safe, pleasant night rides and if not fully satisfied return the lens and your money will be refunded.

For sale by dealers and garages. If your dealer cannot supply you write direct, same price, $3.50 per pair, post paid, any size, anywhere in the U. S. A.

Manufactured by DILLON LENS & MFG. CO., Wheeling, W. Va.

DILLON MULTI VISION LENS

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The Daylo is a necessary part of every Auto Truck Equipment

"As necessary as a monkey wrench or oil can" (*Say those who drive at night*)

Ed says when he forgot his Daylo last night, there was a hoodoo on his trail. In half an hour his engine balked, his lights went "on the blink" and he ran out of matches—and cuss words.

Jim keeps two pet Daylos in his kit—one in the tool box, and one back of the seat cushion where he can reach it instantly.

Bill carries a "2659 Daylo" in his mackinaw pocket and he has a set time to buy his fresh Eveready Tungsten battery.

608

The Light that says: —"There it is!"

All Eveready dealers are now well stocked

With that long-lived **EVEREADY DAYLO** *Tungsten Battery*

Styles 2612, 2616, 2659, 3651

Designed for motor truck use

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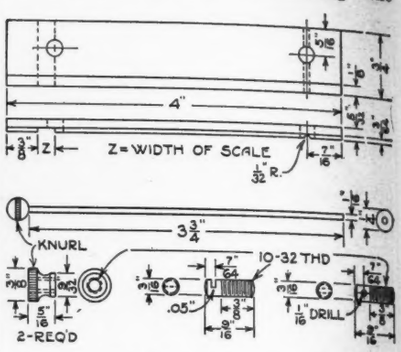
91 Homestead Avenue., Hartford, Conn.

A Depth-Gage and How to Make It

THE design of the depth-gage illustrated is very simple. With the wire at one end and the graduated scale at the other, it can be used for a number of purposes, such as counterbearing, accurately measuring the

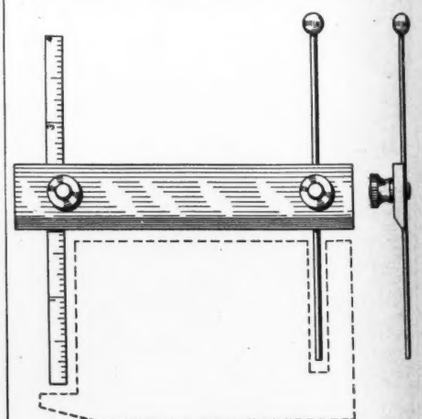


For measuring recesses, counterbearings, etc., a device of this sort is indispensable

depth of a recess, and other things of a like nature.

The base is made of a piece of 5/32-in. tool steel, allowing material enough to finish all over. If tool steel is not available, cold, rolled, or ordinary machine steel will do. The width of slot *Z* should allow the 4-in. scale to slide freely with no play on either side.

A groove with a 32-in. radius keeps the wire at right angles to the base when adjustments take place. Much care should be taken to have the scale slot and wire groove as nearly square at the base as possible, so that the gage may be used as a square if desired.



The completed depth-gage ought to look like this illustration

The wire is made of 1/16-in. diameter drill-rod, with a ¼-in. ball forced upon one end. The measuring end should be hardened and drawn to a light straw color.

The two knurled nut and clamp screws are made of soft steel.

A slight improvement can be made by counterbearing the small end of the nut enough to allow inserting a small coil spring, which will always keep a slight tension on the measuring rods when the clamps are loosened for adjustment, making it much easier to set to a given size.—A. DANE.

Why Automobile Engines Are Ten Years Behind the Times

"GASOLINE"—what is it? Not the name of a definite liquid, like water, alcohol, or sulphuric acid, but the name of a variable automobile fuel.

The gasoline of today is not the gasoline of ten years ago, not the gasoline of last year even. Each year what you call gasoline is becoming heavier—more like kerosene. *But automobile engines are designed to burn the gasoline of ten years ago—not the fuel now called gasoline.* Six million cars must be kept in motion. But there is not enough gasoline of the kind that they are intended to consume to go around. So, the oil refiner has to blend a little gasoline with kerosene-like fuels to supply the demand.

These new low-grade fuels don't vaporize as easily as the old gasoline—particularly on cool mornings. *It's hard to start.*

But worse than that is this: The heavier portion of the fuel-blend is not converted into "vapor." It collects in drops. Puddles of it form in the manifold. *It works down into the crankcase, "cuts" the lubricating oil, and ruins the engine.*

The kind of gasoline that most cars ought to burn can be bought only in a drug-store at drug-store prices.

Most cars are ten years behind the times. They ought to be burning gasoline of ten years ago; they try to burn the fuel-blend of today and don't—quite.

There is only one way to meet the situation:—Make the engine so that it will burn these new heavy fuels. Make it so that only "vapor", not raw fuel, is fed to the engine.

That is exactly what the Chalmers Company has done. In the new Chalmers car is an engine scientifically designed to use all the "gasoline"—not just a part of it.

The Chalmers engineers gave the manifold the Hot Spot that immediately vaporizes a drop that touches it and they designed the Ram's-horn manifold, so that all the six cylinders would receive an equal amount of mixture.

The result is:—

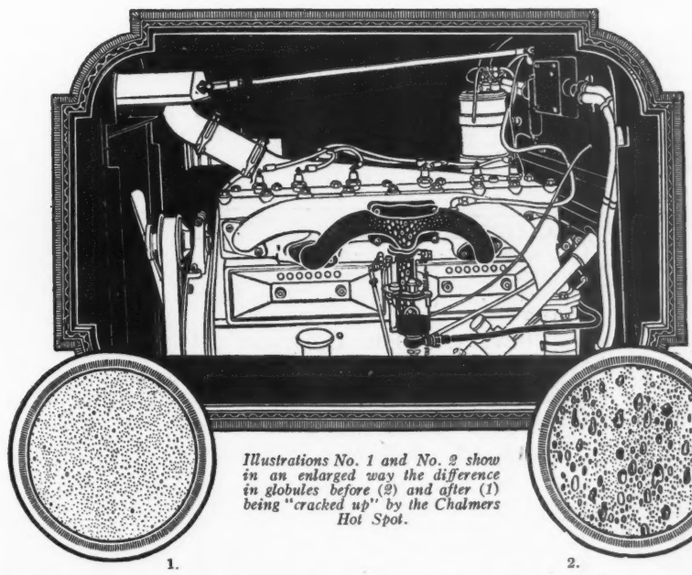
1—You get more power.

2—You start quickly.

3—No raw gasoline trickles into the crankcase to cut the lubricating oil, which means that

4—You save money in repairs.

CHALMERS · MOTOR · CO
Detroit, Mich. U.S.A.



Illustrations No. 1 and No. 2 show in an enlarged way the difference in globules before (2) and after (1) being "cracked up" by the Chalmers Hot Spot.

1. 2.

This is the first of a series of six bulletins in which the wonderful features of the new Chalmers will be explained

"We'd Never Have Got Here Without It"

"Just think of all the fishin' we missed before we got our Harley-Davidson."

There are scores of places—secluded lakes, half hidden streams, far distant hills and woods—that can be reached only with a motorcycle. And there is where the fishing is best, where game is most plentiful—and you can depend on getting there *and back* with a

Harley-Davidson

Miles are but pleasant minutes with this motorcycle. And it does stand the "gaff"—hard riding over give-and-take roads holds no worries for it.

See the new models at your dealer's store.

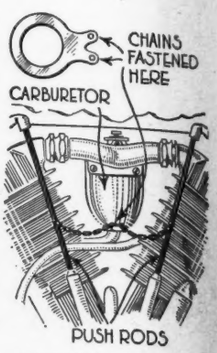
The Motorcycle that is Being Talked About

Harley-Davidson Motor Co.
Milwaukee. Wis.

To Prevent the Loss of Motorcycle Push-Rods

ON many makes of motorcycles, if the intake tappets are not kept carefully adjusted, the push-rods will fly off and be lost. I had this experience recently, and on investigation found that the intake valve-spring was too strong to permit the valve functioning automatically. I had to come home on one cylinder.

To avoid a repetition of this, I secured a couple of lengths of old watch-chain from a jeweler's junk-box, and attached them to the push-rods as shown in the illustration. One end of each chain is soldered near the middle of each push-rod. The opposite ends are attached to a piece of tin cut as shown, and secured under the nut holding the carburetor bowl.



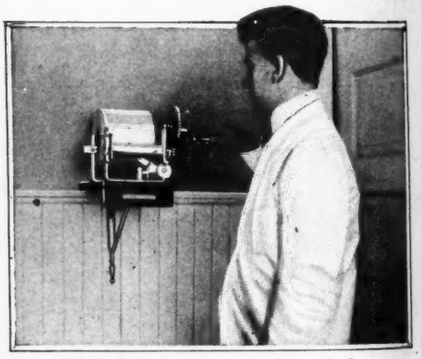
No need for that exasperating loss of push-rods if chains are attached to the push-rods

The intake push-rods work as usual, but should the push-rods jump off they stay with the machine and can easily be inserted again.—JOHN E. HOGG.

A Paper-Winding Machine for Barber-Shops

A NEW paper-winding machine, invented by A. Ross of Buffalo, N. Y., winds three different-sized rolls of paper from a supply roll to be used for the head-rest of a barber's chair.

As a rule, the barber buys his paper already wound, which is extremely high priced. With this device the barber is able to cut the price more than half.



With this device the barber winds his own paper for head-rests at half the expense of the usual roll

A roll of 1⅜-in. paper costs five cents. Wound from a supply roll, it costs only 1¼ cents per roll of 1⅛ in. The device winds a roll of paper in fifteen seconds. The shaft catching the paper winds it, tells you the size, cuts it, and the roll is ready for use.—A. ROSS.

You Can RENT This Phonograph

on our new plan! $10 puts this Young's Superior Phonograph in your home on 30 Days' Trial! Plays all makes of disc records. Cabinet size, 47 ins. high. *Rental applies on purchase.* $125 Value for $62.50. Write for details of greatest phonograph bargain ever offered. Offer Limited. Write Today.

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NOT TOYS BUT REAL APPARATUS

The same as used by operating companies. You had better send your order immediately to insure prompt delivery, as this equipment will not last long at these prices.

110-Volt Hand Generators, 3 bars each, postpaid	$3.00
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Telephone Transmitters, with arms, each, postpaid	.85
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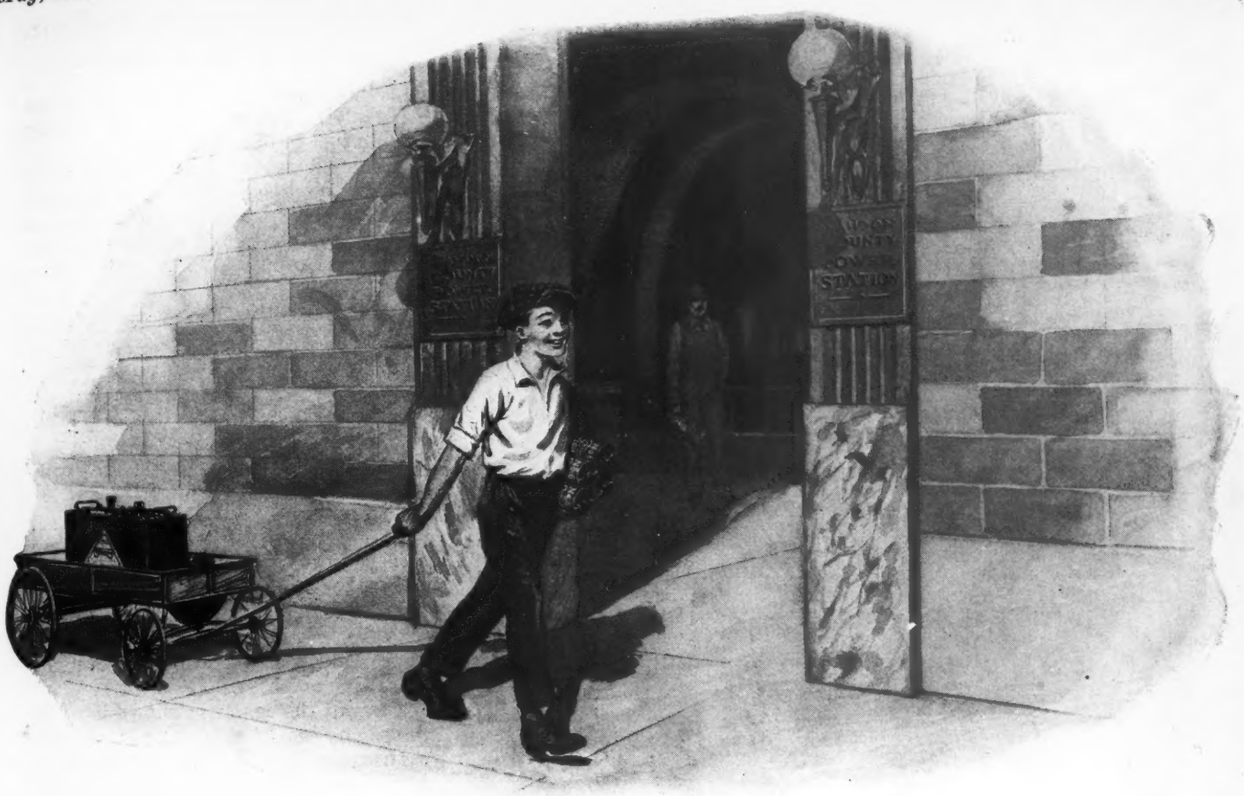


Both make Electricity:—
the Power Station Dynamo and the Fiery little Columbias

THE big dynamo whirling in the power station makes electricity for the big jobs—to light the city; to run the factory full of machines; to propel the street cars.

The fiery little Columbias standing quietly behind the scenes make electricity for all the little jobs—to ring bells and buzz buzzers; to make telephones talk; to run toys for the little folks; to ignite farm engines, autos, trucks, tractors, and motor-boats.

THE DRY BATTERY

THE world is so used to having the Columbia Dry Battery always at its beck and call, the little red fellow's work is accepted as a matter of course.

Yet he is really one of the great marvels of the age—marvelous for what he does—marvelous for his power—marvelous for his long life.

Columbia Dry Batteries are appropriately called "The handy-men of the world."

THE STORAGE BATTERY

THE Columbia Storage Battery is backed up with a *definite guarantee* that makes certain for the purchaser the actual performance to which his purchase entitles him.

And everywhere there is Columbia Service organized to back up that guarantee. Your Columbia Storage Battery has the protection of the Columbia Pyramid Seal stamped on its lead terminals. No one but authorized Columbia Service Station experts will break that seal—they, and they only, have the authority and equipment for resealing.

And if your battery should fail to live up to its guarantee, its intact Columbia Pyramid Seal will show at once that the battery has not been tampered with and you are entitled to thorough repairs or another battery without additional cost.

Columbia Storage Battery Service is all around you—it will be well worth your while to drop in and let them show you how they will save you annoyance and expense.

Columbia
Storage and Dry Batteries

B-19

Hey Jimmie, le'me try your wheel

The whole crowd will want to try this dandy Indian the very first time they see it.

It's built husky like the Indian Motocycle, it's speedy, too, and a dandy hill climber.

The Indian Motocycle type forks, saddle and handlebars make it comfortable and easy to control. The tank contains two dry batteries for the electric head light.

Send us your name and address and we will mail you a beautifully illustrated catalog, and the name and address of the nearest Indian dealer.

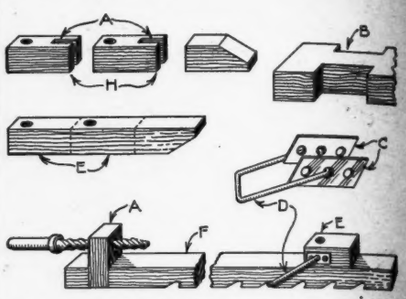
HENDEE MANUFACTURING CO.
SPRINGFIELD, MASS.

Indian Motobike

Making Cabinet Clamps from Broken Hand-Screws

IN and about woodworking shops there may always be picked up any number of broken hand-screws.

A good way to make use of these broken hand-screws is to turn them into clamps. Cut a hand-screw in two at *H*, and then cut off the beveled end,



How broken hand-screws can be used to advantage as clamps for gluing parts

thus making two stationary jaws for the two clamps *A*.

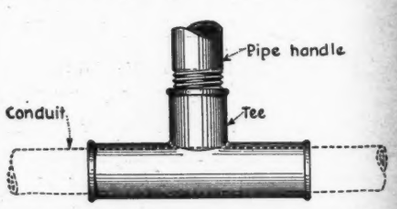
Cut out the center as shown in *A* to fit snugly at *B*, and glue these together, or fasten them with screws from the side. Make the wooden strips the same thickness as the jaws, or only slightly cut out the notches on the bottom to hold the movable jaw.

The sliding jaw is made from the other half of the hand-screw cut into two pieces (*E E*). A ¼-in. iron rod is bent to the shape *D*, and two metal clamps shaped as *C*. Fasten these to the sides of *E*.

When gluing together panels and frames these clamps can be used to hold the pieces together until they are dry. These clamps will prove invaluable about the shop, for they may be used equally well on a number of operations.—E. J. Bomis.

To Manufacture a Conduit-Bending Device

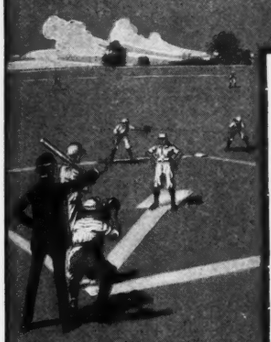
A DEVICE for use in bending the smaller conduit sizes for electric wiring is made by screwing a flanged tee to the end of a piece of pipe.



A practical pipe-bending apparatus which is recommended for its cheapness and simplicity

When using, slip the tee over the conduit to the point where the bend is to be made. Then place the conduit in a vise, or stand on the conduit, and pull or push the pipe-handle. Any curve desired can be bent in this manner, and different-sized tees may be employed for different sizes of conduit.

4,791,172 REASONS For Outdoor Sports



Every War-trained Man a Living Example of the Benefits of Physical Excercise

There were over 4,791,172 men in the military service of our government on the day the armistice was signed.

The high degree of physical fitness attained by the men who are returning from overseas and army training camps is the greatest object lesson on the value of physical training this nation has ever had. Outdoor sports will help them hold the gains of army training. If you—a civilian—have been lax in regard to physical exercise, reform your personal habits and go into training to make yourself as physically fit and efficient as a soldier.

You owe it to the nation as well as to yourself, to be at your best—physically, mentally—so that you may do your part in meeting the new demands of reconstruction.

Take up some form of athletic activity. It will strengthen your physical fibre, steady your nerves, add to your reserve of vitality, and increase your personal efficiency.

WILSON Sporting Goods

The government bought millions of dollars worth of sporting goods for the boys in service—much of it was "Wilson." Wilson's Sporting Goods and Athletic Equipment have been a big factor in the physical training of our soldiers and sailors.

Their superiority is recognized by leaders in every sport. The Wilson line includes equipment and apparel for baseball, golf, tennis, football, basketball, soccer, fishing, swimming, gymnasium and track.

Sold by Leading Dealers Everywhere

Look up the Wilson dealer in your vicinity, he is well worth knowing and we will be glad to furnish you his name.

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THERE IS WILSON EQUIPMENT FOR EVERY SPORT

DURING these fast-moving times of readjustment, of reconstruction, when everyone is crowding the duties of days into hours, the need of healthful, blood-making, out-in-the-open exercise is more than ever necessary.

Nothing ever has equaled the bicycle as a means of keeping the body fit for the tasks ahead, the brain clear for the quick action demanded of it.

Nothing equals the bicycle as a low-cost utility and pleasure vehicle, as a method of positive, practically expenseless conveyance to and from work or for riding recreation.

It means long rides in the fresh air—rides that bring the glow of health to your cheeks, strength to your body, clear eyes, keen thinking ability, zest for the day's doings.

The Columbia was the *first* American-made bicycle. For two generations it has served its riders—men, women, boys, girls—through steadfast, reliable performance.

And here's something worth bearing in mind when you select your new bicycle: After a thorough test by Government engineers of American-made bicycles, the Columbia Military Model was adopted as standard for the United States Army. Of the thousands of bicycles bought by the Government for war work, approximately three of every four were Columbias!

For 1919 the Columbia offers a model for every individual preference, for every purse limitation. Described and pictured in the 1919 Columbia Catalog. Send for it.

WESTFIELD MFG. CO.
45 Lozier Avenue, Westfield, Mass.

When the Little Ford Knocks

It's time for you to find out why and to remedy it without delay

By G. F. Collins

THE thumping and vibration of the big end bearing is familiar even to the motorist of a few months' experience. To those motorists who have never attempted to take up the big end bearing of a connecting-rod it may seem a more complicated job than it really is, but to the more experienced motorist there is only the danger that certain important details of the operation may be neglected, with serious results.

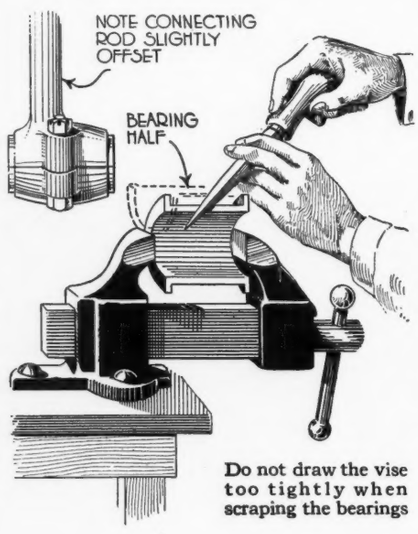
The repair necessary depends entirely upon how far the wear has been allowed to go, but the most common cases require only a few simple operations, with a minimum of labor and tearing down of the engine. The front part of the car should be jacked up as high as possible, raising the wheels at least a foot from the ground so that the repairer may get beneath his car, on his back, without much trouble.

The crank-case, which is generally attached to the base of the engine with sixteen bolts, is first removed. Remember that there is oil in the crank-case, so drain it off before beginning the work. On the bigger cars the removal of the crank-case is a two-man job, and if it is not removed easily a screw-driver or file should be inserted into the joint. In doing this be very careful that the gasket is not destroyed, for if this happens a new gasket will be necessary or oil leakage will result.

Locating the Trouble

As the base drops away the crank-shaft and the big end bearings are exposed, and here the faulty bearing must be located. The crank-shaft is turned so that the cranks are vertical, when any slackness will make itself apparent by holding the connecting-rod firmly and locating the vertical movement that denotes wear in that particular bearing.

The bearing—if it is of the usual white metal-lined type—is held together with two or four bolts with castle nuts and split pins. When these are taken out the bearing cap may be removed together with its liner and the shims (brass packing pieces) between the halves of the bearing. To do the work right the piston and connecting-rod should be taken out, and while this seems a hard job it is simple to push up the connecting-rod until it is clear of the crank-shaft and then turn the crank-shaft a little to one side so that the rod may easily be drawn out. Never do this when the crank-pin is at top dead center, for if the piston-ring should be moved up the cylinder beyond the end of the bore, it will snap out and catch on the edge of the valve pocket, often rendering the piston impossible to move until the ring is broken.



Do not draw the vise too tightly when scraping the bearings

The crank-pin is sometimes found to have worn oval, and in this case upon the piston replacement it must be tightened up as much as possible.

Be sure to mark the end of the bearing halves, so that they may be refitted in their relative positions. Note whether the connecting-rod is slightly offset, for if the rod should be assembled the wrong way there will be a great strain upon the rod and on one wall of the cylinder when the bearing bolts are tightened up, that is, if the top half of the bearing will fit on the shaft at all.

The edges of the babbitt shell may be made smooth by rubbing them with a sheet of emery-cloth laid on a flat bench, applying an even pressure to the work. If there is much metal to be taken off a file will be necessary. Unless the looseness of the whole bearing is apparent, it will not be necessary to interfere with the top half of the bearing; and should this be the case a new bearing is the only solution of the problem.

To Find the "High Spots"

Scraping in the bearing consists of using a bearing scraper to remove the portions of babbitt that stand out from the bearing and prevent the whole surface from coming in contact with the crank-shaft. To find these so-called "high spots" the crank-shaft should be smeared with Prussian blue, after assuring oneself that there is no grit

B&B

TIME was when Hygiene was but little known, and practiced less. Today it is the handmaid of daily affairs.

Bauer & Black has devoted twenty-five years to making first aid in medical science a household word—bringing its beneficence within the reach of all.

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THE products symbolized by the letters B & B have become models in medical practice. They manifest what science and skill can accomplish, ingenuity invent or vigilance create, to safeguard and conserve health.

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present. After the bearing liners have been wiped clean they must be taken, one at a time, and applied to the shaft, being pressed on as firmly as possible, at the same time revolving them around the shaft. If there is very little metal to be taken off, the bearing should be properly assembled and bolted up, although the piston need not be inserted in the cylinder. Now, if the liner is removed, the high spots will show as streaks in those places that have come in contact with the shaft. These places must be removed.

The bearing half to be treated is clamped in the vise by an end flange, this being the most convenient position for operating the scraper, though many prefer it as shown by the dotted outline in the sketch. In any event, it should be held by a flange only, with the back resting on the vise, as jamming it between the jaws of the vise is liable to make it buckle.

Best Kind of Scraper

Scrapers are not expensive to buy, and there are many kinds on the market. The best form is the half-round type, about nine inches long, with two cutting edges. The scraper should be held firmly by the handle and pressed lightly on the work with the other hand. Be sure to make all the cuts in one direction, and only a small amount of babbitt must be removed at each stroke to secure a clean surface.

Try the bearing on the shaft quite often with a coat of Prussian blue, so that the process can be definitely noted. When the patches made by the Prussian blue cover practically the whole surface of the bearing, the bearing should be assembled and bolted up for the last few trials.

Finally, when the bearing halves ar considered a good fit, they may be re assembled, after making sure that th oil grooves are clear of grit and deep enough.

Note that it is very often unnecessary to remove any babbitt from the bearing surfaces; all that is required to be taken off is a slight amount of babbitt from the bearing cap edges and the lower half of the bearing, the reason being that the bearing is only slightly loose. In those cases where shims are fitted, these will be found threaded on the bolts between the two halves of the bearing, forming a substance to keep the bearing halves apart. The removal of one or more of these shims enables the bearing to be tightened without any filing or scraping, so that when bolted up the liners will be tight on the shaft but not too tight to turn easily.

Much care must be taken, in finally reassembling, to see that the bearing is lubricated, that the bolts are properly tightened by turning each a little at a time, and that the split pins are inserted, for if the bearings are not taken up equally all around your little old Ford will soon be knocking again.

Relax

Just settle down in your pet chair, fill your pipe right up to the brim, light up and let the good smoke roll peacefully out—*that's relaxation.* There's nothing better after a hard day than a quiet evening with your

WD C Wellington
THE UNIVERSAL PIPE

The W. D. C. triangle trade-mark has been the sign of supreme pipe value for more than 50 years. It is not only on every Wellington, but also on other pipes that we make of every style, size and grade. Price for price, grade for grade, there is no better pipe made than a W. D. C.

The rich brown bowl between your thumb and fingers is genuine French Briar, broken in sweet and mellow because it was seasoned by our own special process. It's guaranteed against cracking or burning through. There's never an unpleasant interruption. The well catches all moisture and holds all tobacco crumbs that are inclined to roam up through the bit. The smoke comes, clean and dry, through the *top* opening, *away* from your tongue.

Spend this evening with a Wellington Pipe. Any good dealer can supply the size, shape and grade you want at 75 cents and up. Just be *certain* it's a Wellington—then relax.

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WORLD'S LARGEST PIPE MANUFACTURERS

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Write today for this big, new Free Book on
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"The Biggest, Brightest, Best Magazine for Boys in all the World."

YOUR boy wants "boy" reading; the kind of stories that thrill and absorb; articles that give him practical information and real pointers on boy activities.

Because *The American Boy* has appreciated the boy viewpoint for years, it is the eagerly sought favorite of more than 500,000 splendid, normal American boys each month. *The American Boy* supplements home and school in starting HIM right. Give your boy this wholesome reading.

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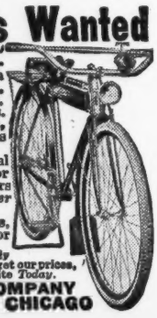
Everywhere to ride and exhibit the new **Ranger "Motorbike"** completely equipped with electric light and horn, carrier, stand, tool tank, coaster-brake, mud guards and anti-skid tires. **Choice of 44 other styles,** colors and sizes in the famous **"Ranger"** line of bicycles.

DELIVERED FREE on approval and **30 DAYS TRIAL.** Send for big **free** catalog and particulars of our *Factory-direct-to-Rider* marvelous offers and terms.

TIRES Lamps, Horns, Wheels, Sundries, and parts for all bicycles—at half usual prices.

SEND NO MONEY but tell us exactly what you need. Do not buy until you get our prices, terms and the big FREE catalog. Write *Today.*



MEAD CYCLE COMPANY Dept M109 CHICAGO

Home from Work in a Jiffy!

Dayton Bicycles

WHEN the day's work is finished, then come the few hours of fun, recreation and relaxation! They are short enough at the best. Why waste even a minute in walking home—waiting for crowded street cars—or riding in them through the delays and confusion of the after-work jam?

Swing into the saddle of your Dayton Bicycle! It will take you home comfortably, quickly—and speedily! The air and the exercise will freshen you up and put you in fine condition for a real meal and a good time!

Among their many superiorities DAYTON Bicycles are noted for their easy running qualities.

Dayton hubs, cups and cones are turned from bars of solid steel. First they are carbonized and then case-hardened. After the cones are case-hardened the bearing surfaces are ground absolutely smooth on a carborundum wheel, reducing friction to a minimum.

The hub bearings are extra large High-Duty A balls. And, front and rear, the Dayton offers 2-Point hub bearings.

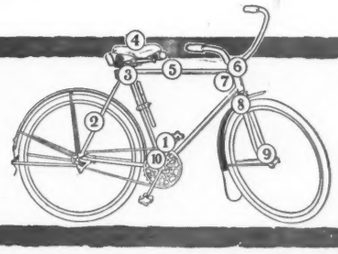
No wonder the Dayton runs like a top! See the Dayton line at your dealer's. Study the mechanical superiorities shown below. Our catalog describes and pictures the Dayton line completely.

THE DAVIS SEWING MACHINE CO. DAVIS MADE DAYTON, OHIO.

We Back This Trade-Mark With Our Reputation

Write today for Catalog B-9. It is free

Cycle Dept.,* THE DAVIS SEWING MACHINE COMPANY, *Dayton, Ohio



1 One-piece drop-forged cranks. Hobbed sprockets.
2 Special design rear fork, giving extra clearance between wheel and fork sides. Flush rear fork ends.
3 Drop-forged seat-post cluster, giving extra strong grip on seat-post.
4 High-grade padded leather saddle with double action springs. Leather tool bag and complete tool equipment.
5 Seventeen process enamel finish of Dayton Carmine. Tough and long wearing. Heavy coat of copper under all nickel plating.
6 Dust-proof head adjusting cone. Extra large High Duty ball bearings. Cones case-hardened in cyanide.
7 Outside joint-head construction. Eleven inner reinforcements in frame, all dip-brazed.
8 Double anchored fork sides with solid steel spool between plates.
9 Front hub and cups of special design turned from solid steel bar. Two-point frictionless bearings.
10 Seamless crank hanger bracket, extra reinforced.

$600 to $3120 Yearly

From a little Waste Space

The Greatest Payer

That a Store or Theatre Can Have

Took in $10,000.00

"Have had our machine over 3 years and have taken in more than $10,000 on pop corn and peanuts." Bloomington, Ill., Pop. 26,850.

Bought Him a Car

"Profits derived from Butter-Kist machine first 12 months paid for machine and bought me a $1,200 automobile besides." Electra, Tex., Pop. 640.

Paid for Itself

"Paid for machine out of profits in less than year." Mt. Pleasant, Ia., Pop. 3,874.

Increased Other Sales 97%

Made 49,015 sales of Butter-Kist Pop corn and peanuts first year and it increased my sale of magazines 97%. Evansville, Ind., Pop. 76,078.

Used and praised by Confectioners, Druggists, Theatres, Variety Stores, Grocers, Bakeries, Restaurants, Stationers, Department Stores, Cigar Stores, Billiard Parlors, Florists, Commissaries, etc., in cities and towns of all sizes from 400 population up to the largest.

Do you realize that America is now on the threshold of the greatest business activity this country has ever known? Every day we are getting letters from Druggists, Confectioners, Grocers, Bakers, Department and Variety Stores and Film Exhibitors who want the Butter-Kist Pop Corn Machine to attract and expand the enormous trade let loose by the ending of the war.

What are you doing to seize this life-time opportunity? Will you start right here and now by sending for our wonderful Butter-Kist book and see the sales records and photographic proof of the hundreds and thousands of stores and theaters that are earning from $60 to $250 clear profit per month AND MORE from a little waste floor space 26 by 32 inches?

Pays 4 Ways—*Look!*

1—Motion makes people stop and look. 2—Coaxing fragrance makes them buy. 3—Toasty flavor brings trade for blocks. 4—Stimulates all store sales or theater attendance.

BUTTER-KIST

Pop Corn Machine

Our easy payment plan gives every buyer a chance to pay right out of his Butter-Kist sales as thousands have done. So don't let anything prevent you from investigating.

Don't think you have to be located in a busy center to make this machine pay. The beauty of the Butter-Kist is the way it draws trade to you.

Valuable

This coupon has started many a business man on the road to new profits.

Each read an advertisement like this and had the good horse-sense to know that it doesn't cost anything but a postage stamp to investigate.

If this machine pays big profits in towns of 300 and 400 population as well as in the largest cities, then no man in business can afford to ignore it. Mail the coupon now for full facts and amazing success records.

Holcomb & Hoke Mfg. Co.
140 Van Buren St., Indianapolis, Ind.

For Proofs, Photos and Prices

HOLCOMB & HOKE MFG. CO.
140 Van Buren St., Indianapolis, Ind.

Without obligation, send me your free Butter-Kist book—"America's New Industry" with photos, sales records, and estimate of how much I can make with your machine.

Name.....

Business .....

Address.....

Here's a Match-Safe for the Sportsman

THERE are many kinds and styles of match-safes for the outdoor man, but the simplest yet seen is one made of a section of bamboo.

A section is cut out, one end below a ring in the cane, the other cut through

A match-case made from bamboo is water-tight and will not sink if dropped overboard

the hollow portion about four inches above the ring.

The ring forms the bottom of the cylinder, and the open top can be made water-tight with an ordinary cork.

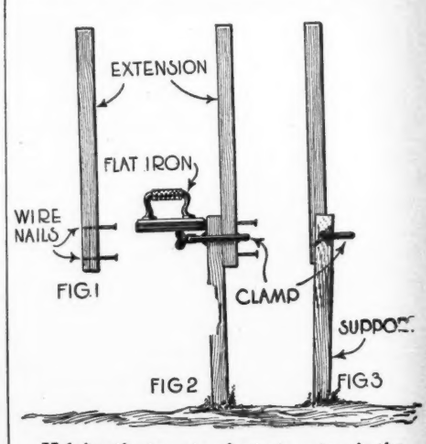
This kind has the advantage over the metal match-safe because it will float if accidentally dropped overboard.—L. B. ROBBINS.

Lengthening the Supports to Increase Tomato Crop

IT is usually necessary to attach a vertical extension to a large number of stakes in the tomato patch at certain stages of growth.

The extensions are first prepared by driving wire nails into them, so that the points of the nails are flush with the surface of the opposite side, as in Fig. 1.

Each piece is then fitted into position and held by an ordinary iron clamp, as



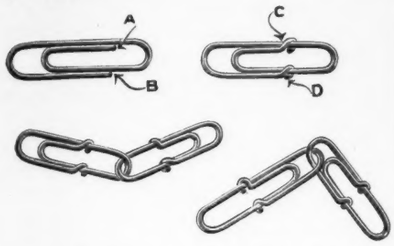
Helping the tomato plants to get up in the world by means of lengthened supports

in Fig. 2. Holding the edge of a flat-iron against the bottom stake will steady the support while the nails are driven through and clinched.

This device will help in getting every top stick "plumb."—JAMES M. KANE.

A Chain Made from Ordinary Paper-Clips

A STRONG and pleasing-looking chain can easily be made out of wire paper-clips of the type shown in the illustration. Bend over the ends



Paper clips will make a novelty chain which is made practical by bending the clip ends

A and *B* into the shape shown in *C* and *D*. Of course, two links must be joined together before starting to bend the ends.—JAMES M. KANE.

Making Overhead Shaft Oiling Safe

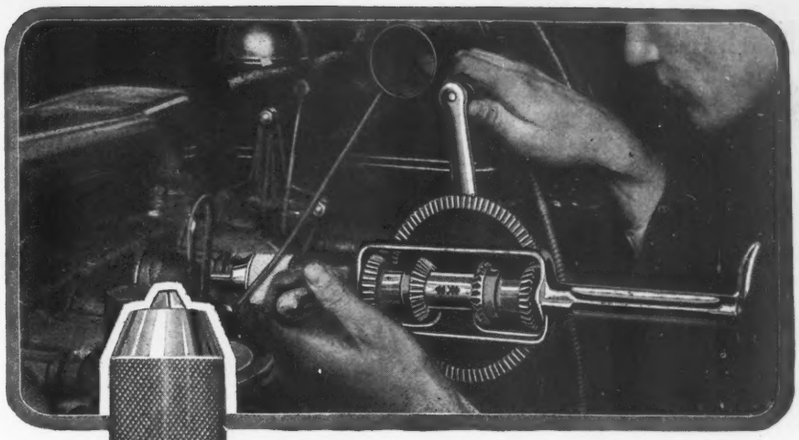
ONE of the most important jobs in a machine-shop is the oiling of overhead shafts, such as line bearings, counter-shaft bearings, loose pulleys, etc. At its best, it is a very dangerous job. It is usually done with a long-

This kind of oiling apparatus is an improvement over old oiling methods

spouted oil-can and the help of a cumbersome ladder.

The illustration shows a better and saner method of oiling. Attached to the oiler's back is an air-tight box filled with oil, a hand-pump on the side supplying sufficient pressure to enable the oil to flow up through the rubber tube into the copper nozzle and from there into the machinery being oiled. The ladder is self-explanatory, and may be adjusted to any height by a simple raising or lowering of the pin seen under the man's feet.

This device will save time and labor, aside from the consideration of its invaluable "safety first" principles.—WILLIAM KOELPIN.



The Drill That Cuts "Coming and Going"

Holes can't be drilled in advance and carried in the tool box like other "spares."

But you *can* drill holes with the "YANKEE" Ratchet Breast Drill, when and *where* wanted, even in places inaccessible to other tools.

It has two speeds and five adjustments:

(1) Plain Drill; (2) Left-hand Ratchet; (3) Right-hand Ratchet; (4) DOUBLE Ratchet; (5) Gears locked for changing drills.

Now suppose you must drill for a new attachment; drill out a broken bolt, or drill for some other repair where there is not sufficient space to turn the crank of a common drill.

Don't waste an hour tearing down the job, but go right in after that hole with a "YANKEE," first setting your adjustment for "DOUBLE Ratchet." Even if you can only move the crank to and fro an inch, the drill turns forward *continuously*, cutting the same as if a full turn of the crank could be made.

Speed and Ratchet Adjustments changed at a finger touch and without removing drill from work.

Speed Shifter at hub of crank; Ratchet Adjustment shown between small gears.

NOTE: "YANKEE" Ratchet Hand Drill No. 1530, weighing only 20 ounces, has the same Ratchet Adjustments as the "YANKEE" Ratchet Breast Drill.

"YANKEE" Ratchet Breast Drill

Price $8.75

No. 1555. Length 17 in. Three-jaw chuck for round shank drills up to ½ in. diameter.

No. 555. Length 17½ in. Two-jaw chuck for holding both rounds and squares.

Your Dealer Can Supply You

Write for free "YANKEE" Tool Book, illustrating "YANKEE" Tools in action doing work that common tools cannot do; Bench Drills, Chain Drills, Ratchet Tap Wrenches, Removable Square-finished Vises, Plain Ratchet and Spiral-Ratchet Screw-drivers.

North Bros. Mfg. Co., Philadelphia

"YANKEE" TOOLS

Make Better Mechanics

Make Your Writing *T-a-l-k!*

Just as oratory puts the power of emphasis into the *spoken word*, so the—

MULTIPLEX HAMMOND "WRITING MACHINE"

—puts the all-telling power of emphasis into the *written word*.

No other typewriter

turns cold type into **living, breathing words**—words pulsating with the writer's deepest convictions—words expressing to a nicety his most conventional mood—words showing always absolute correctness—**in busines, professional or social usage.**

The business man

who uses the Multiplex can put character and individuality into his letter, and can emphasize the important parts by **changing instantly** from one style of type to another.

Note the six distinctly different type-styles reproduced in this advertisement.

The mail order man

can put the same emphasis on the selling points of his product as he would in talking. **"Just turn the knob"** and you can change from commercial type to italic, giving emphasis **when** and **where** you want it.

The lawyer who swayed

judge and jury by his eloquence can write his **brief** on the Multiplex so that **every telling point scores with the judge.**

The author

can prepare his manuscript so that no climax or no subtle point will be lost—**can see his story practically in print** before it goes to the publisher.

The Multiplex is unlike any other typewriter

It is revolutionizing typewriting. Its work is as great an improvement over the typewriter as the earlier typewriter over the fountain pen, or the fountain pen over the quill. Just think of being able to choose from over 365 different type-sets, including all languages!

The Multiplex is typewriting perfected to the art of fine printing and engraving—**plus personality.**

Mail Coupon for FREE BOOKLET

It will show you how, with the Multiplex, you can put the force of emphasis into your typed matter—how you can drive home with strength of accent the fullness of your argument—how you can write with the same convincing force that you use in speaking—an **exclusive feature** of the Multiplex.

We will also send our pamphlet, **"The President and His Typewriter."**

Also—a PORTABLE Model

For Traveling—for Home. Weighs about 11 lbs. Full capacity. Ask for special folder.

Write your name, address and occupation below and mail to—

HAMMOND TYPEWRITER CO.
639 E. 69th St., New York City

Name: .....

Address: .....

Occupation: .....

BIG PROFITS for YOU in HB BATTERY CHARGING

Start now to build big battery business. Opportunities best this season—more old cars driven—new Fords with storage batteries. HB use s are easily clearing

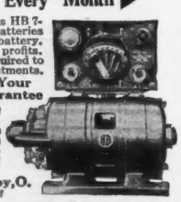
$100 to $200 Extra Profit Every Month

Some even more. Get in the game! This HB 7-Battery Charger recharges 1 to 7 auto batteries at once. Current cost 12c to 15c per battery. Motorist pays 75c to $1.50. Figure your profits. No electrical or mechanical experience required to operate. No expensive renewals or adjustments.

$25 Puts This Money-Maker in Your Garage on Money-Back Guarantee

Balance in 9 monthly payments of $20 each. Earnings easily pay for machine. Pin your $25 initial payment check to this ad and send today for trial order. You run no risk under HB Absolute Money-Back Guarantee. Don't delay. Get busy! Get those profits!

HOBART BROS. CO., Box S5, Troy, O.
Successful manufacturers since 1893



YOU NEED A MOTORCYCLE

Secure one at small cost by putting a STEFFEY MOTOR on your wheel. Thoroughly PRACTICAL and RELIABLE. Made by the oldest manufacturers of motor attachments.

Send stamp at once for lowest factory prices.

STEFFEY MFG. CO. Dept. S. 5025 Brown St., Philadelphia, Pa.

A Cheaply Constructed Arc-Type Soldering-Iron

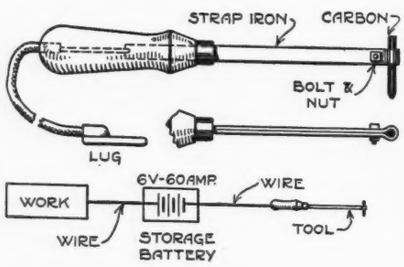
A SIMPLE form of arc soldering-iron operating from a 6-volt, 60-ampere storage battery that can be cheaply constructed will often be found of value.

It consists primarily of a holder made as shown in the illustration. A strip of brass ½ in. wide, ⅛ in. thick, and 8 in. long is bent at its center around a form ½ in. in diameter. Holes are then drilled through the brass strip near the loop thus formed, in order to pass a small bolt used to clamp the carbon electrodes in place.

The other ends of the brass strip are driven into a wooden handle after a heavy lead has been soldered to them. This lead is made from a 2-ft. length of twisted lamp-cord, using the conductors in parallel. A lug can be provided at one end to attach the holder to the storage battery. A second lead is also provided with a lug for attaching to the battery, and the other end bared to make connection with the work being soldered.

To use, insert a short length of hard carbon in the loop at the end of the holder, and connect the lead to one pole of the storage battery. The work to be soldered is connected to the other pole by wrapping the bared end of the wire around it close to the point to be soldered.

After cleaning the joint and applying the flux, take the tool in the right hand



As efficient as the manufactured article is this home-made soldering-iron which utilizes the storage battery's current

and a length of solder wire in the left. Touch the carbon point to the work and withdraw it slightly to start the arc. The metal will be heated almost instantly to the melting-point of the solder, and the latter can then be applied.

It might be thought that this short circuit would damage the storage battery, but such is not the case. The usual amount of current used is thirty amperes, and at this rate it would require nearly two hours completely to discharge the battery, whereas the tool is seldom in use for more than a minute.

The amount of current required varies with the work in hand. Light articles require about ten amperes, heavier work more. The current can be regulated by connecting the lead to the work farther away from the point of contact.—THOMAS W. BENSON.

DIXON'S ELDORADO
the master drawing pencil

Quick Thinking Demands Quick Writing

Whether in Writing, Accounting or Drawing, the pencil which most easily and quickly records your mental processes is Dixon's Eldorado, *"the master drawing pencil."*

In the 17 perfect degrees of hardness and softness you are assured of a pencil that will make your pencil-work a delight. Leads, strong, responsive, and long wearing. The Eldorado makes for genuine economy.

Made in 17 degrees. 6B (softest) to 9H (hardest), HB (medium) for general use.

Get a trial dozen from your dealer, or send 15c for our grade chart and 3 full-length pencils worth double the money. Please mention your dealer's name and the nature of your pencil work.

Made in 17 degrees

DIXON'S "ELDORADO"—*the master drawing pencil*—HB

Joseph Dixon Crucible Co.
Established 1827
Dept. 120-J Jersey City, N. J.
Canadian Distributors
A. R. MacDougall & Co., Ltd., Toronto, Ont.
There is a Dixon-Quality pencil, crayon, and eraser for every purpose

High School and College Students—Attention!

If you were told that you could *earn* your college expenses would you be interested? Would the testimony of hundreds of students who have done so convince you? Do you want to earn a scholarship of $250 or over during the coming summer vacation?

We have helped hundreds of students. We can help you. Write today for our booklet "Victory."

Review of Reviews Scholarship Fund
31 Irving Place New York, N. Y.

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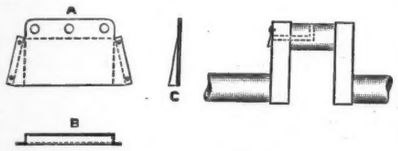
Oiling the Crank-Pins of an Automobile Engine

THE adjustment of the connecting-rod bearings is one of the most common repair jobs on an automobile engine. Probably the chief reason why these bearings wear faster than the others is that they are not lubricated properly under all conditions. The system described below has given very good results and has almost eliminated connecting-rod bearing trouble.

Most of the oil delivered to the main bearings escapes the ends and flows along the crank webs, and is finally thrown off by centrifugal force. If small scuppers are placed at the ends of the crank-pins this oil will be caught and may be carried through the pin to the bearing.

In the right-hand illustration one throw of the crank-shaft is shown with the scupper in place. The oil

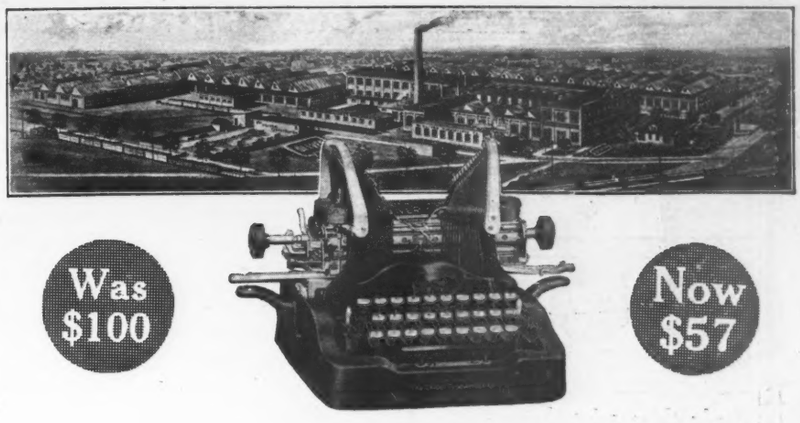


Connecting-rod bearing adjustment is one of the most common yet complicated jobs about the automobile engine

leads are indicated by dotted lines. The radial hole should be drilled first, and should extend to the center of the pin. Then a hole should be drilled through the center of the pin until it connects with the radial hole. The smallest drills possible should be used; probably an 1/8-in. radial hole and a 3/16-in. lead will work out best in the average engine. In very large engines a slightly larger hole would probably give better results. In a case where the crank-pins are hollow, the scupper placed over each end and over the radial hole is all that will be necessary.

The other illustration shows a design for a scupper that is well adapted to most crank-shafts. Sketch *A* shows the layout or pattern, *B* shows a side view, and *C* an end view. Sheet brass or copper should be used. The end of the shaft should be smoothed slightly, and then the scupper riveted or brazed in place. The crank-shafts are carefully balanced in high-speed motors, so care should be used not to change the balance any more than necessary.

Before installing such a system a careful inspection should be made, to make sure that there is room for the scuppers at all places as the shaft revolves. Great care should be exercised in laying out this work, as the crank-shaft could easily be damaged, and in a job of this sort mistakes are very costly, usually necessitating the purchase of new parts. A study of the engine's interior is essential to every amateur motorist.—S. E. GIBBS.



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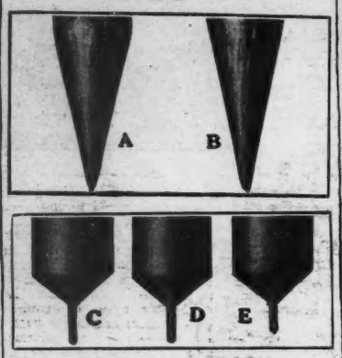

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Charging Storage Cells from Service Mains

By Peter J. M. Clute

WHERE cells are employed for portable purposes, some convenient method of charging them from the ordinary supply source must be provided.

The method selected will depend mainly on the available charging current source. Alternating current, as such, cannot be used for charging, and when it is the only available source of power, some auxiliary means must be installed for converting it into direct current. This can be accomplished by the use of a motor-generator set, or a rotary converter, or a mercury-vapor arc rectifier.

If the available source is the 110-volt d.c. lighting circuit, connection can be made as shown in Fig. 1. It is advisable to connect an ammeter in the circuit, although this is not necessary. In order to limit the charging current to its proper value, lamps are arranged in series with the cells to be charged, the number of lamps necessary depending both upon the line voltage and the rate of charging of the cells. A 16-c.p. 110-volt carbon lamp has about 220 ohms resistance and will carry 0.5 amperes; a similar lamp of 32 c.p. rating has about 110 ohms resistance and will carry 1 ampere. Therefore, by connecting five 32-c.p. lamps in parallel, a charging current of about five amperes can be maintained from a 110-volt supply.

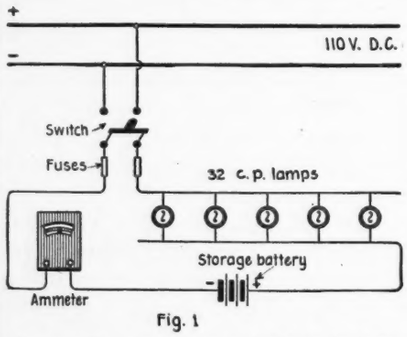

Fig. 1

An ammeter can be connected into the 110-volt circuit, although it is not necessary

If the supply pressure is 550 volts, the charging current can be limited to, say, 5 amperes by connecting in parallel five series of lamps, each series containing five 32-c.p. lamps, as shown diagrammatically in Fig. 2. In both cases, of course, two 16-c.p. lamps in parallel could be used instead of each 32-c.p. lamp. In case it is desired to charge at a lower rate, fewer lamps will be found necessary, with the time for charging increased proportionately.

Lamps form a very convenient means of adjusting charging current, but an adjustable rheostat is frequently used, as shown in Fig. 3. This resistance should be such that some of it can be cut out as the voltage of the cells increase, and it must be made of wire large enough to carry at least 5 amperes with overheating.

Charging with resistance in series involves a large loss of energy, but in the case of small portable cells this waste is not a very serious matter, especially as the use of the series-resistance constitutes the most convenient and simple means of charging from existing supply mains.

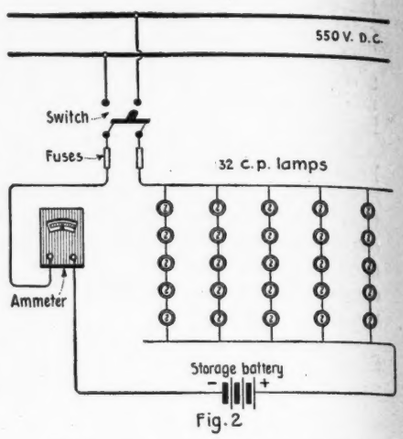

Fig. 2

By connecting in parallel five series of lamps the charging current can be limited in amount to 5 amperes

The charging voltage must always be greater in value than the discharge voltage of the cell being charged. The charging current should be so controlled that the charging shall be at the normal eight-hour rate. Charging current must always flow through the cells from the positive pole to the negative pole, namely, in a direction opposite to the direction of flow of the current on discharge.

When there is any doubt as to the direction of flow of current, a test should be made to ascertain whether the positive plates are connected to the positive pole, so that the charging current flows in at this pole. The most convenient method of testing the polarity is by means of a voltmeter, which will give a scale deflection only in cases when the positive side of the line is connected to the terminal marked. A careful adherence to the above instructions will result in a maximum amount of current in the cells.

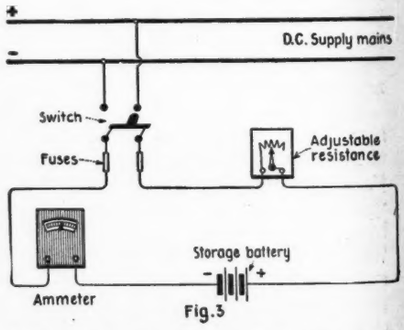

Fig. 3

A rheostat is very often used as a convenient means of adjusting the charging current

What a Pocket Mirror Will Do

A SMALL dessert glass, tumbler, or wine goblet is held up by a performer and seen to be empty. Removing a silk handkerchief from his breast coat pocket, the performer shows that it also is empty. He covers the glass with the silk for a moment, then withdraws it and puts it back into his breast pocket. In the glass will be seen reposing a five-dollar bill, a small American flag, or any object the performer may fancy.

This trick is made possible by using a mirror glass. A mirror is cut to fit inside the glass so that it can be placed in the center in an upright position. In fact, the performer may use two mirrors fastened back to back with strong glue, only a small piece of cloth separating them. The cloth is allowed to protrude just a fraction over the edge of the cut mirror. This prevents the mirror from "talking" when it is pulled away from the glass itself.

The audience cannot see the flag because the mirror makes the glass appear empty

The bill is crumpled up and placed behind the mirror which is set in the middle of the glass. Looking into the tumbler, it appears empty, because of the reflection in the cut mirror. The affair is then covered with the silk handkerchief, and the two forefingers noiselessly lift out the mirror when whisking off the silk. This leaves the bill, which expands to fill the extra space created.

Should anyone wish to examine the handkerchief, the performer can safely pull it out of his pocket and show it, for the mirror is so heavy that it will have slipped to the bottom of his pocket.

A cut-glass tumbler is preferable, and the fitting of a small mirror is not difficult, as only a rough cut is necessary.—MERRITT HALE.

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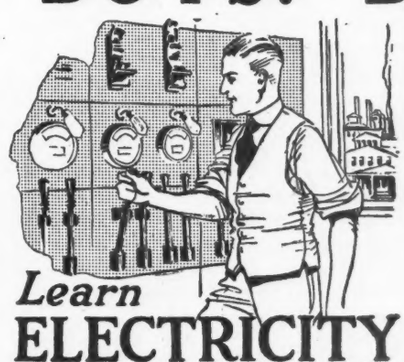

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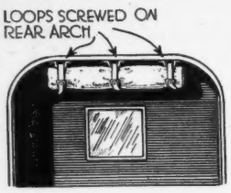


Curtains carried like this will always be clean and smart looking

A Mechanical Scarecrow

By Raymond V. Wilson

A WELL known method of frightening birds away from the garden is to tie corks along a string stretched the length of the field and just above the young plants. Feathers are stuck in the corks, so that the faintest breeze will cause them to move and thus frighten the birds away. But birds frequently feed in the early morning and late evening, when there is usually no breeze.

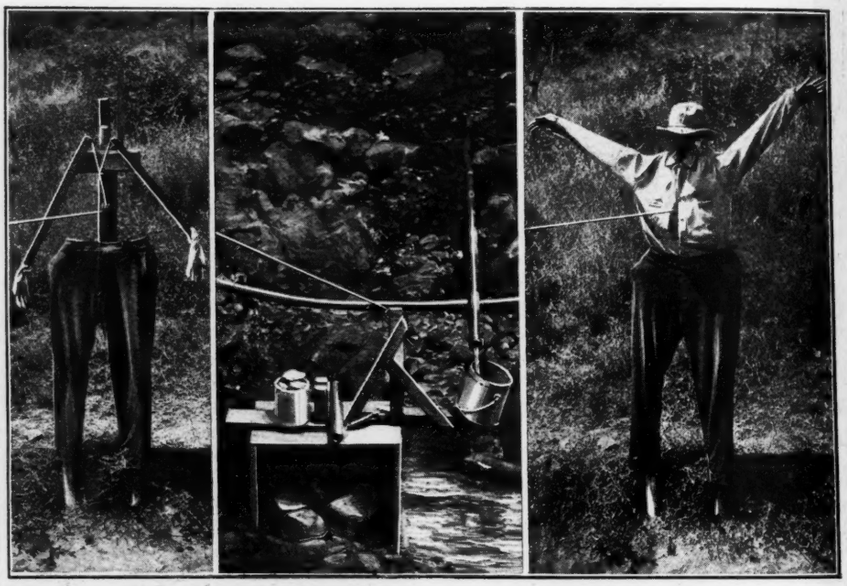
That which frightens birds, animals, and human beings most is the sudden or unexpected. The success of the mechanical scarecrow is that he waves his arms, not continuously, but intermittently, suddenly, and unexpectedly.

Running water is the motive power that pulls the string and causes the scarecrow to wave its arms. The string-pulling mechanism consists of two pieces of narrow board mounted upon hinges. At opposite ends of a box, at a slight angle, the water bucket—which might be a paint-can, as shown in the center illustration—is mounted by wires that hold it securely.

On the opposite end is fastened a piece of pipe or some other object that will act as a weight to counterbalance the weight of the empty bucket. An upright is mounted on this board, to which is fastened the string that pulls the scarecrow's arms.

On the left-hand hinged board are mounted the trigger and a can weighted with rocks. This weight and the trigger prevent the bucket from dipping before it is filled with water. When the bucket is full, its weight overcomes that of the can of rocks, which it lifts. The bucket arm then slips past the trigger, allowing the bucket to dip and pull the string which will wave the scarecrow's arms.

The bucket, having discharged its contents, is no longer heavy, and is drawn back to its original position by the "bird-cage" spring seen at the right top of box. The scarecrow's arms will also assist by their weight. The bucket arm slips back past the trigger, and is held in place by it until the bucket fills again. The size of the stream of water flowing into the bucket determines the frequency of the scarecrow's antics. Three or four times a minute ought to frighten away the boldest bird or animal.



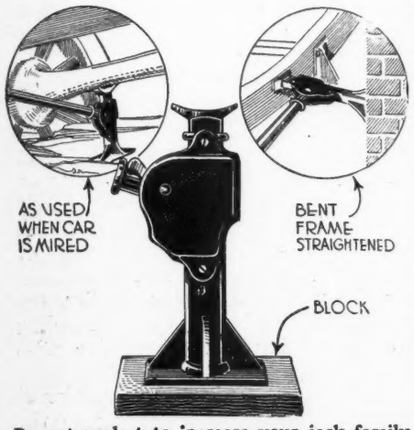
Here's a practical and automatic way of assuring yourself that birds or animals are not destroying your garden vegetables and crops

The Invaluable Automobile Jack

THAT little jack stowed away under the seat of your car will do many helpful things, but three more of them, of different sizes, will save you much time and temper.

For instance, when you get hopelessly stuck in mud, sand, clay, or even snow, your jack may be the means of getting your car out of its predicament and save you that six-mile walk to the nearest village to get a span of horses.

Every jack should be fitted with a 2-in. block of wood as broad and long as will conveniently fit into the car. If the jack is so equipped, it will allow the car to be jacked up out of the mudhole, so that the rear wheels can have



Do not neglect to increase your jack family by at least one or two before taking a tour

boards slipped beneath them for traction. If necessary it is not a bad idea even to use the car cushion for traction; that is, if no planks are at hand and you are hard pushed for the necessary material. In fact, anything that will enable your car to get on solid ground is cheaper than waiting all night for assistance.

One of the cleverest uses for the jack was seen recently, when a wounded soldier drove into town in a heavy car that had a broken spring. As he had a crippled leg, he was not strong enough to lift the body of the car to place a bumper or log between the axle and the frame. But he had wisely provided himself with a small low jack which conveniently fitted into the space between the axle and the body.

The jack is indispensable during the spring overhauling or when there are bent parts to the body or frame. For example, bent body parts may be straightened by giving the jack a leverage against the garage wall, working the jack against the wrenched part.

Jacks have long been used in garages that are not equipped with huge machinery for straightening bent frames and even front axles. In addition to this, when straightening a bent frame with a jack the chassis does not need to be dismantled, as it would if heat were applied.—G. F. COLLINS.

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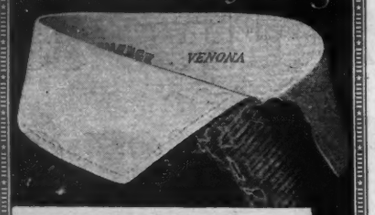

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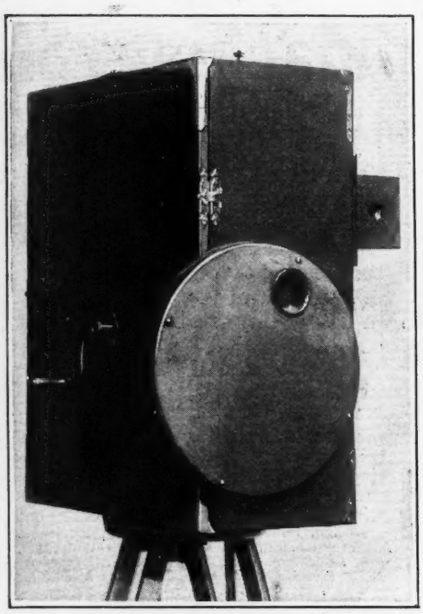
Make Your Own Motion-Picture Camera

By Leo Hirsh

THE motion-picture camera illustrated is made of parts that may be obtained at small expense.

No effort is made to give actual measurements, as it may be easily built large or small, according to the camera at hand and the ideas of the builder. Regular motion-picture film is used in the camera, and may also be used for projection purposes or prints made from the negative, bound in book form, and thumbed to view the action.

Remove the back of the camera to be converted, in such a manner that a wooden shield may be fitted to the space usually occupied by the film or



How the camera will appear when it is finished. Any size camera may be used

plate. An opening exactly in the center ¾ by ⅞ in. is cut in the shield, being the height and width of the lens.

A wooden frame to be placed directly back of the camera is made in the shape of an H, the upper part of the H for the roll of film, the center for attaching the film-moving mechanism, and the lower part to guide the film back to the take-up reel. An opening is made in the center of the wooden frame, the size being the same as the opening in the camera-shield, the openings to be opposite each other for the purpose of focusing, and, in case the camera is used as a projector, to allow the light to pass through the film.

As the film must move exactly ¾ in. to an exposure, it is better to use the mechanism for a toy projector rather than to make it.

The shutter of the camera used is left open, or means is provided for operating it from the outside of the box. The shutter is made of a circle of tin cut in half and attached to the drive-shaft so that the halves may be spread apart or brought together to compensate for the variation of bright and cloudy days.

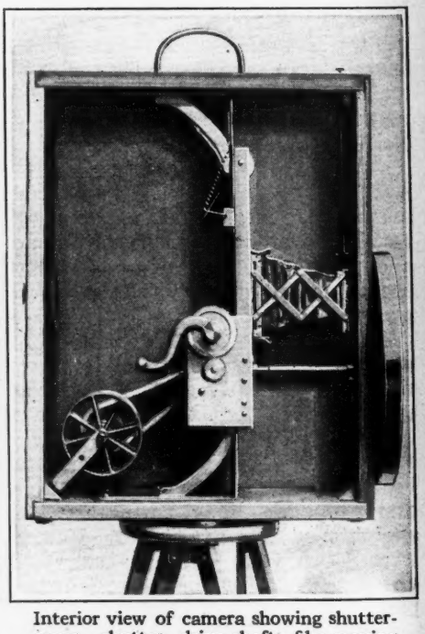
To time the shutter with the film movement, two bevel gears are used. One gear is attached to the cam-shaft of the film-moving mechanism and the other to the drive-shaft of the shutter.

The drive-shaft, to which the shutter is attached, extends outside the camera-box, and a wooden circle, which is hollowed to inclose the shutter, is fastened to the box.

To time the shutter to the movement of the film, all that is necessary is to see that the opening in the shutter passes the lens opening after the film has moved, and that the shutter is closed while the film is moving. This may be done by setting the beginning of the opening of the shutter in front of the lens just after the cam that moves the film has brought the film down for exposure.

It is necessary to have a film-meter to tell how many feet of film have been exposed. The one used in this camera was built by bending a wire in the shape of the letter L. The small part of the L rides the film, and the long part, extending through the box and the calibration, is marked off by running through one foot at a time. As the roll of film gets smaller, the indicating hand will move according to the position of the part that rides the film roll.

The view-finder is made from a small camera, and, after attaching to the box, is marked to indicate the position of the subject on the film. The take-up reel is to wind up the film after the exposures are made, and is run by a belt

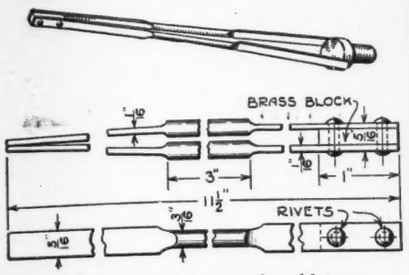


Interior view of camera showing shutter-cover, shutter drive-shaft, film-moving mechanism, make-up reel, and film-meter

from the cam-shaft. The wheels may be obtained from a ten-cent toy, spaced the width of the film apart, and large enough in diameter to hold the capacity of the roll of film used.

Handy "Pick-Ups" for Small Work

BELOW is described an easily constructed pair of "pick-ups" for inserting or holding small parts of machinery while assembling them. By the rounded portions in the center they are easily spread with the thumb and finger and retain a firm grip.



An improvement over the old type of tweezers, that must be continually depressed and gripped

The small filling block at the end is tapered, which, when the halves are riveted together, brings the points in contact with considerable spring. The points, or halves, are made of 3/16-in. steel wire drawn out at the ends to 1/16 in.

For the air motor, automobile, and other small intricate machine assembly they are very convenient, as the points retain their grip, enabling the operator to accomplish much more than would be possible with other types.—F. W. BENTLEY, JR.

Ask Grand-Dad—He Knows It's True

THIS illustration of an old grindstone and frame—particularly the frame—shows that the lack of a proper frame for the grindstone did not hinder

Oh for the good old days when nature supplied our simple wants!

the early settler. He went out into the woods, selected a strong tree fork of the right shape, and cut it down. Then he bored three holes in it, inserted the legs, and had what he wanted.—JAMES M. KANE.

The Red Signals of Danger Ahead

LIONEL STRONGFORT

"Dr. Sargent, of Harvard, declared that Strongfort is unquestionably the finest specimen of physical development ever seen."

IF you were driving a locomotive at sixty miles an hour, you would watch out for every red light of warning along the track with an eagle eye; you would slow down instantly, as soon as you saw one; your own life and the lives of hundreds of others would depend on *immediate action.*

Your life depends right now—and the happiness if not the lives of those dependent on you—on the way you drive your human machine along the railroad of life and watch out for and heed the red warnings of danger ahead, that Nature flashes before your eyes.

Are you tired out before the afternoon is half over, unable to work quickly or think straight? *That's one of Nature's red lights.* Do you wake up in the morning feeling like a human wreck, and stagger through your daily work miserable with indigestion or biliousness, loggy with constipation, hacking and spitting from chronic catarrh—without an ounce of reserve vitality in you or any interest or ambition in your work? Those are WARNINGS of a smash up ahead, unless you take steps IMMEDIATELY to avert it.

Keep Your Human Machine in Order

You can't make a success in life; you can't advance or even hold your present position, unless you make yourself FIT and KEEP YOURSELF FIT. *Everything* depends on it; every chance of happiness for yourself and for your wife and children; the kind of children you will have depends on it, there's no getting away from the fact. No man's physical and mental condition remains the same; if you are not getting better *you are steadily getting worse* and the smash up will come; it's one of Nature's inexorable laws.

Never mind what brought you to your present condition; GET OUT OF IT. I will help you, just as today I am helping thousands of other men, whose vitality has been sapped and manhood lost by overwork, by inherited ailments, or by youthful errors and indiscretions of their own. BRACE-UP—take hold of yourself; get back your original snap and pep and punch —*you can do it*; I GUARANTEE that you can improve yourself 100 per cent., if you will only follow my directions for a few weeks.

Strongfortism Will Keep You Running Right

Strongfortism will build you up from the beginning, strengthen your heart and lungs and every other vital organ; develop your figure, round out your muscles, clear up your brain and make you FIT. Strongfortism is an embodiment of the *natural methods* by which I built myself up into the strongest man in the world without the aid of any druggist's dope, and the whole secret of it consists of Living Life as it ought to be lived. And that always means getting the greatest enjoyment out of it.

Don't wait—that's what YOU want, and you can get it if you stir yourself out of your lethargy and go about it the right way. Indicate on coupon herewith your main ailment and send same to me promptly with your request for MY FREE BOOK, **"Promotion and Conservation of Health, Strength and Mental Energy;"** it will tell you all about HOW TO GET IT. There's no charge for it; send three 2c stamps to cover postage and packing and I'll mail you a copy at once, also sending you personal, private information and professional advice. DO IT RIGHT *NOW!*

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. . Neuritis	. . Nervousness	. . Increased Height
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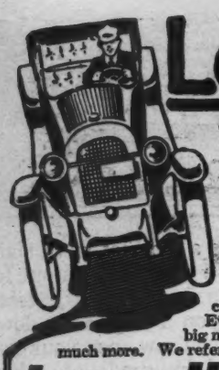

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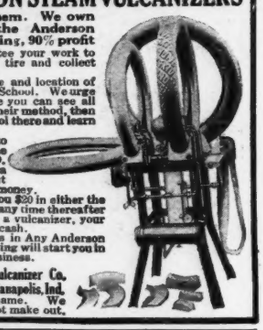

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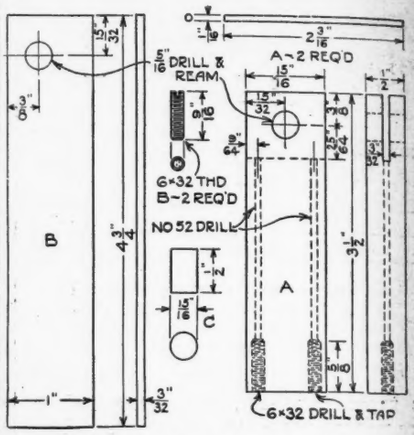
A Solid Square that Is Easily Made

A reliable solid square is a tool that every mechanic takes great pride in possessing, especially when it is of known accuracy. The advantage of the one shown in the illustration is that it may be adjusted to a perfect right angle at any time it is found to be



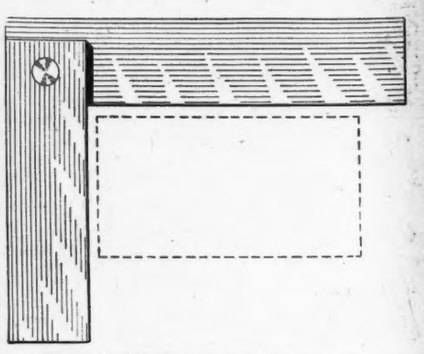
Instructions should be followed carefully, studying the diagram for the relation of parts

out of tune; though with reasonable care this defect should not often appear.

The beam *A* and blade *B* should be made of a good grade of carbon tool steel well annealed. The beam has a 3/32-in. slot milled into one end to admit the blade, and two No. 52 drilled holes which the 1/16-in. die drill-rods pass through, used to hold the blade in adjustment.

If trouble is encountered in drilling so deep a hole with so small a drill as No. 52, the size may be enlarged to 3/32 or ⅛ in. In this case it will be necessary to change the size of the adjusting screws to No. 8 by 32.

The pivot *C* should be made of tool steel, hardened, and should be a light press fit in the beam, while the blade

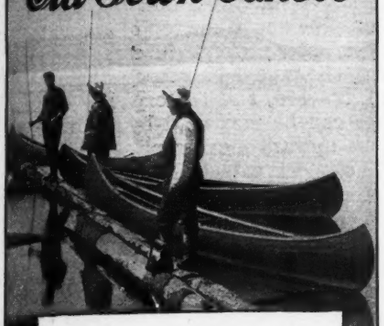


Heat the blade in a clear fire to a medium cherry red to harden the edges

should be a free fit on *C* and also have a small amount of clearance in the bottom of the slot in the beam when it is assembled to allow for adjustments.

Hardening the blade is not absolutely necessary, but of course it lengthens the life of the tool. If this method is to be used, however,

"Old Town Canoes"



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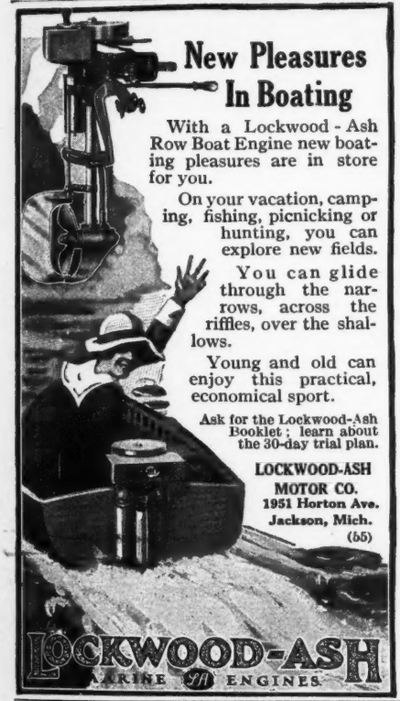

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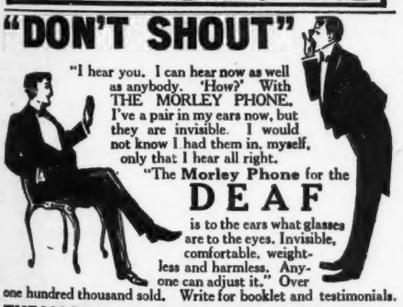

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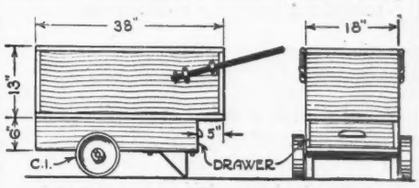
procure four steel or cast-iron blocks, about 1½ in. square and about 6 in. long, with one side of each of them machined perfectly flat, placing two of them ¾ of an inch apart, parallel lengthwise, and with machined surfaces upward. Heat the blade in a clear fire to a medium cherry red, and instantly lay it on top of the already placed blocks, being careful to have ⅛ in. overlap on each, also laying the remaining two on top, exactly over the bottom ones. If this operation is done quickly and properly, the cooling properties of the blocks will be found sufficient to harden the edges and at the same time keep the blade flat.

It will be necessary to grind the two parallel edges, for they will be more or less warped after the hardening is completed.

There are several methods of setting a square to an exact right angle. A simple and very accurate way is to turn in the lathe a perfectly straight cylinder, and, facing one end to a bevel edge—using, perhaps, a piece of 2½-in. die pipe or tube—produce a standard which can be used at any time to test the accuracy of the square—A. DANE.

A Portable Tool-Box for the Repairman

IN engine-houses where locomotives are given running repairs, a machinist necessarily needs some heavy



A tool-box that will accommodate any number of tools and is not too heavy to be handled by one or two men

tools and small parts such as cotter keys, nuts, washers, etc. If he had to keep these articles in a locker, a great deal of time would be consumed in going after the tool to do a certain job. If a machinist is furnished with a portable tool-box like the one illustrated, he can take his tools and small parts from place to place very quickly.

A box 13 in. high, 18 in. wide, and 38 in. long (outside measurement) is made from 1-in. lumber. On the bottom of this box are secured two pieces of 2-by-6-in. lumber, as shown. On the inside faces at the bottom, two 1-in. square pieces are fastened for slides, and across the front end is nailed a piece of 1-in. lumber. A drawer is made and put in this space, providing facilities for small parts. Wheels are placed and a wrought-iron piece forged for a stand.

Handles are made of pipe and secured to the sides of the box with pipe-clamps, allowing the handles to work free. A cotter-pin in the lower end prevents the handle from pulling out, and, being slightly expanded on the upper end, it is kept from dropping out. When not in use, the handles are pushed down out of the way.

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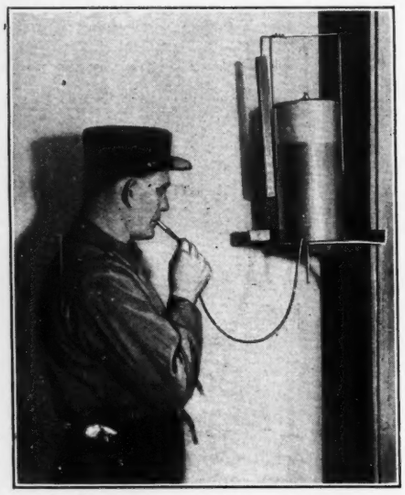
How to Make Your Own Lung-Tester

NO gymnasium outfit, whether in the athletic club, the office, or the home, is complete without a lung-tester. A reliable lung-tester not only gives information about the capacity of the lungs, but also provides means of competition for those who are proud of their prowess. By practice, too, a boy can increase the capacity of his lungs. Here is a home-made lung-tester suitable for private use or for a small gymnasium without funds to purchase one.



The fireman is "blowing himself" to find the condition of his lungs

The materials needed are: A cylinder of rust-proof galvanized material about 11 in. high and 7½ in. in diameter; a similar cylinder about 10 in. high and 7¼ in. in diameter; a ⅞-in. tube 11 in. long; a ¼-in. tube about 10 in. long; a foot of rubber tubing; a rectangular or cylindrical ⅛-in. rod about 2 ft. long; and a ruler or smoothly planed piece of wood to serve as a gage.

Solder the ⅞-in. tube in a vertical position to the bottom of the larger cylinder, and then attach the ¼-in. tube to it near the bottom and extend it out through the walls of the tank. Fasten the rubber tubing to the protruding end of this tube, and at the end insert the glass tubing to serve as a mouth-piece.

The smaller cylindrical tank is to be inverted in the larger, and work up and down. To provide guides to hold it in position, solder ears to both the inside and outside tanks. By means of these attach the ⅛-in. cylindrical or rectangular rod, bent as shown in the photograph, to the bottom tank, and adjust the ears on the upper tank so the rod will slip through them freely. Attach the pet-cock to the top of the upper tank in order to allow the air to escape and the device to be set for a second test.

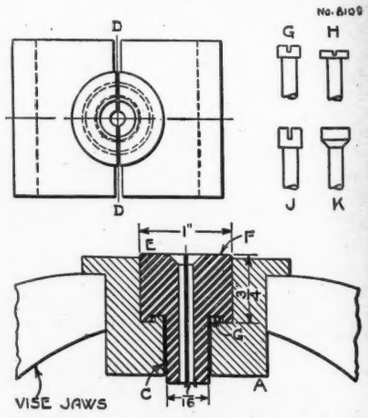
In operation, the lower tank is filled with water to within about an inch of the top. The user then blows through the mouth-piece, and the air from his lungs passes through the rubber tubing, the ¼-in. tube, and the upright ⅞-in. pipe above the top of the water. As the water prevents its escape downward, the expelled air forces the upper tank upward, and the capacity of the lungs can be measured by the extent of the upward movement.

The gage is attached as shown in the photograph. The zero mark is even with the top of the upper tank when it is at its lowest level. The graduations can be inserted by calculating the capacity of the tank, of course using inside measurements. The glass tubing should be sterilized between tests by dipping it in alcohol and rinsing it in water.—FRED TELFORD.

A Rivet-Heading Die for Use in the Bench-Vise

SPECIAL rivet-heads, or even screw-heads, can be easily formed with the die and holder shown in the illustration. Brass, copper, and soft iron wire may be easily shaped. The holder *A* can be made of brass or machine steel. An iron or brass casting may be used. In either case, the piece should be nicely machined for good results. The hole in the center should be counterbored as shown, and the hole *C* should be drilled and reamed for a smooth finish. A cut 1-16 in. wide should be made at *D-D*, dividing the piece *A* exactly in half. The cut surface should then be filed smooth to remove all burs. The raised section *G* is intended to hold the die when it is taken from the vise.

The die *E* can be turned from tool-steel rod to the dimensions shown.



The surplus metal may be filed off, leaving a perfect head to the rivet

This piece should also be cut in half, the cut in this case being 1-32 in. wide. All burs must be carefully removed and the surfaces filed smooth. The die should then be hardened so that the hammer blows will not mar the surface *F*.

Separate dies can be made for the different shaped heads. Illustrations *G*, *H*, *J*, and *K* show four types of heads different from the one in the holder, and still other types can be designed.—FRANK W. HARTH.

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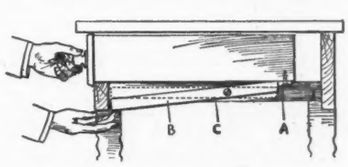
clip may be made from a safety-pin. The ends are cut off and bent as shown in the sketch, and a copper wire is soldered to the back end of the pin.—V. H. TODD.

How to Make a Secret Lock for a Drawer

A SECRET lock that can be made and fitted to a table or desk drawer in a few minutes is herewith illustrated. It consists of a piece of hard wood, *A*, firmly screwed into the under side of the drawer at the back, and another piece of wood, *B*, pivoted on one of the side runners or cross-pieces on which the drawer slides. A strong, heavy screw should be used for the pivot, and it should be located well



It will be difficult for a stranger to find a secret drawer like this

back of the center, so that the weight of the lever keeps its rear end always in contact with the under side of the drawer. A nail, *C*, prevents the lever from dropping when the drawer is opened.

This form of lock does away with the troublesome key, though it is a good plan to cut out a fake key-hole in the front of the drawer to prevent investigation of the real method of locking. The drawer automatically locks itself every time it is closed, and is released with the fingers of one hand while the other hand pulls the drawer open.—MORRIS G. MILLER.

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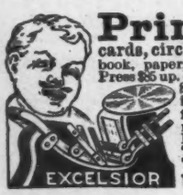

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Rules Governing the Contest

(1) Contestants are not limited to the number of methods of utilizing hairpins which they may describe. But only one method can possibly win the first prize, only one the second, and only one the third. The contest is open to everybody.

(2) The method of using hairpins must be clearly shown either in a photograph or in a drawing. If a drawing is sent in, it need not be made by a skilled draftsman. It is sufficient that it should be intelligible. While pencil sketches will be considered, contestants are requested to make their drawings in ink on bristol-board. The views should be sufficient in number to set forth the use of hairpins very clearly. The contestant's name and address should appear on each sheet of drawings.

(3) The drawings or photographs must be accompanied by a description, preferably typewritten, in which the method of utilizing a hairpin is clearly given. It must be written on one side of the paper only, and it should not be more than 500 words in length. The name and address of the contestant should appear in the upper left-hand corner of the first sheet of the written description.

(4) The drawings and description entered by contestants must be received by the POPULAR SCIENCE MONTHLY not later than 5 P. M. on June 30, 1919.

(5) The judges of the contest will be the editors of the POPULAR SCIENCE MONTHLY.

(6) The first prize of $25 will be awarded to the contestant who, in the opinion of the judges, has suggested the simplest and best method of utilizing a hairpin.

The second prize of $15 will be paid to the contestant who submits a method next in merit.

The third prize of $10 will be paid to the contestant who submits the method third in merit.

(7) The winners of the contest will be announced in the earliest possible issue of POPULAR SCIENCE MONTHLY. A description of the methods which won these three prizes offered will duly appear in the pages of the POPULAR SCIENCE MONTHLY, together with the names of the winners.

(8) The editors of the POPULAR SCIENCE MONTHLY shall have the right to publish meritorious methods of utilizing hairpins which do not win a prize. The regular space rates will be paid to the contestants who submit manuscripts on the methods thus selected.

(9) When a contestant submits more than one method, the description and drawing by which each is set forth must be sent as a separate unit.

(10) No manuscripts or drawings will be returned to contestants.

(11) Send drawings and specifications to the Hairpin Contest Editor, POPULAR SCIENCE MONTHLY, 225 West 39th Street, New York City.

Side-Tracking Pipe for the Purpose of Economy

A BRACKET for holding iron pipe, made of a single piece of strap-iron, will carry pipes up to six inches in diameter. There appears to be no

Anybody who has accidentally kicked a six-inch pipe knows the value of a pipe-rack

reason why it could not be utilized for larger sizes.

The ease with which the pipe is removed is an advantage over old methods.—ERNEST SCHWARTZ.

How to Give Longer Life to a Paint-Brush

AS a precaution in preventing brushes from becoming deformed by resting upon the bottom of the paint-pot when not in use, the following method is suggested:

Bore small holes in the handles of the

Any number of brushes may be kept in the same pot, since none of them rest on the bottom

brushes and run a stiff wire through the holes, making sure that the holes are in proper position to compensate for the length of that particular brush. This will always keep the brushes from cramping upon the bottom of the pot.—JAMES M. KANE.

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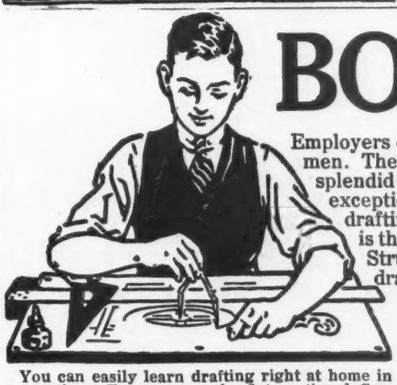

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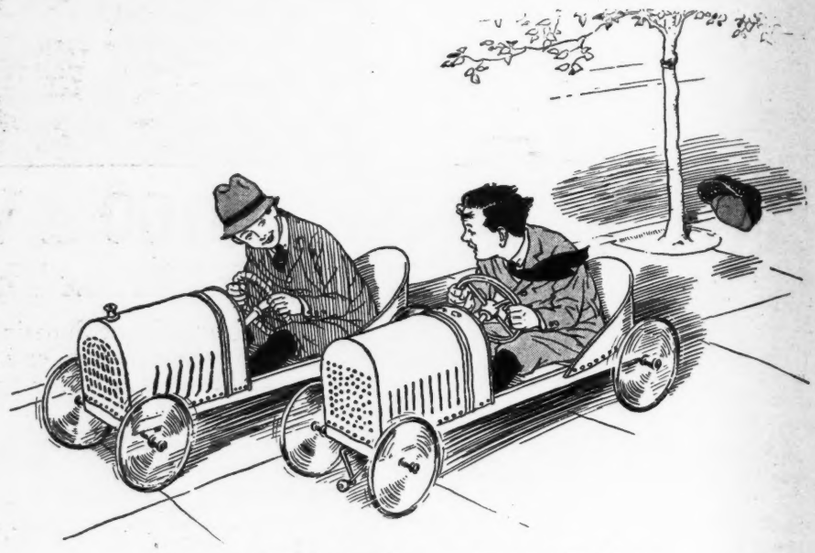
The Wash-Boiler Becomes an Automobile

When painted and striped it looks like the real thing

By **R. J. Stevens**

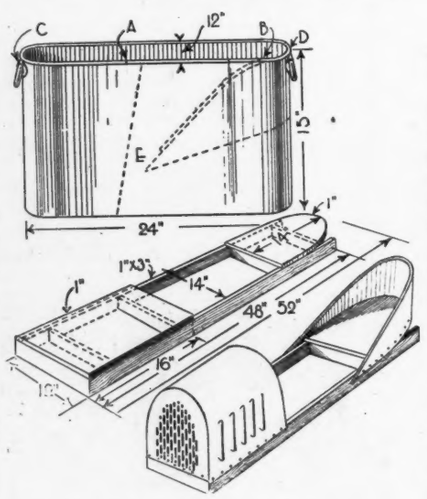
A NEAT, light, and very durable body for a toy automobile can be made quickly and inexpensively from an old wash-boiler; and at the same time, if the work is neatly done, the body properly painted, and the hood striped to represent the radiator, it will have the appearance of the expensive store article.



For all the world like a real automobile, the "flying start" is made realistic by young America's imagination

There are no details given here as to the steering and running gear, because every boy mechanic is thoroughly familiar with the many designs used.

The first process, in cutting up the boiler, is to saw through the rim *A* on both sides of the boiler, about 1⅛ in. from the line denoting the cut for the hood—the object being to have as much of the wire rim as possible for reinforcing the seat from *E* to *B*, without robbing the hood.



How the body is applied to the frame, and the method of cutting the boiler

The wire rim is not cut at *B*, but the sheet-metal is unfolded from the rim, from *A* to *B*, and the hood is then cut off. In making the cut from *E* to *B* allowance should be made for enough material to fold over the reinforcing wire.

Note that the chassis is so constructed that the width of the hood measures 2 in. more in the back than in the front.

The last sketch shows the general appearance of the body. The boxing up of the inside of this will depend entirely upon the type of steering gear used.

Transferring Oil on Vessels by the Siphon Process

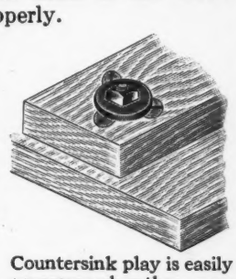
WHILE employed to oil countershafts in a large machine-shop, I found the task of emptying the oil drip-pans and saving the oil a job requiring some time and skill.

I secured a 5-ft. length of ⅛-in. tubing and bent one end in the form of a hook, with a bend of about ½-in. radius—this end being the top of the siphon, or the part to hook over the oil drip-pans to remove the oil.

To start the siphon effect of the oil-tube, I used a deep vessel to catch and save the oil, putting about 3 in. of oil into it. By dipping the bottom of the siphon into the oil in the salvaging vessel, hooking the tube into the oil drip-pan, and lowering the vessel, the pull of the oil in the bottom of the tube started the siphon effect and the oil drip-pan was soon emptied. Of course, the larger the tube, the quicker the process.—WILLIAM MCCARTHY.

To Prevent a Countersink from Wabbling

A COUNTERSINK, especially the kind known as the rose, has a tendency to wabble when a comparatively large hole is to be worked in sheet-metal. This causes the hole to become uneven and thereby unsightly, and prevents the head of the screw from seating properly.



Countersink play is easily overcome when three-way screws hold it in position

A simple and infallible remedy for this trouble consists in clamping a piece of hard wood to the back of the metal to be worked. If the hole to be countersunk is already large to start with, the center should be marked on the wood with a center punch. It is still better to drill a small hole through the place where the center will come in the wood, as this makes it easier for the countersink to bite.

This causes the point of the countersink to be firmly engaged; and, since all play is thus eliminated, it will be found that a perfectly true, clean hole in the metal will be the result.—HENRY SIMON.

Submerged Scissors Cut Glass Easily

OFTEN an odd-shaped piece of glass will get broken, as, for instance, in an electrical instrument; and it is very difficult to cut an odd-shaped piece of glass without special guides. Ordinary window-glass may be cut to almost any desired shape by holding it beneath the surface of a pan of water and cutting with house shears.

Submerged scissors will do the work of a glass-cutter if care is used

Of course, it cannot be cut accurately straight across the piece, but it may be "chewed out" very much the same as can be done with a piece of cardboard.—V. H. TODD.

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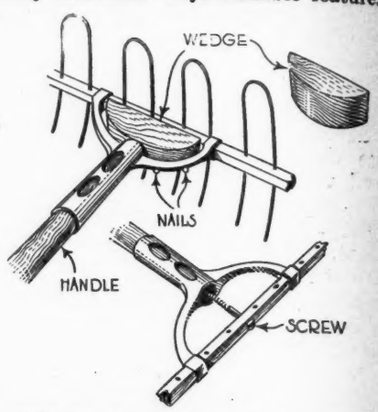
One Way to Improve the Lawn-Rake

THE best type of lawn-rake has this drawback: the tooth-holding bar always becomes loose, and in this condition is decidedly unsatisfactory.

The method here illustrated will always keep the tooth-bar tight and do away with this objectionable feature.

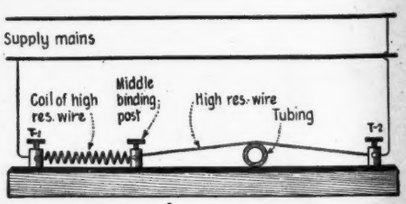


With this idea applied to the lawn-rake all annoyances will be a thing of the past

Cut a soft pine wedge and fit it between the arms that hold the tooth-bar. Force in the wedge, but not hard enough to break the arms. Four small nails driven in beneath the arms will keep the wedge in place. Bore a small hole through the tooth-bar, run a long screw through the wedge and into the handle, and you will have a rake always ready for use.—JAMES M. KANE.

Cutting or Breaking Gage-Glass with Electricity

AS shown in the illustration, a high-resistance wire is arranged between binding-posts on a suitable base; line connections are made at terminals T_1 and T_2. Tightening or loosening the middle binding-post will allow adjustment for accommodating different sizes of tubes. Then the resistance wire is looped around the glass at the point to be cut and connected to the post T_2. After the current has been turned on for a while, and the wire has become red-hot, remove the glass tube and plunge it into water. This will produce a clean break.



The wire must be drawn tightly about the gage-glass or a short circuit will result

The wire must be drawn tightly around the tube, and must be slightly separated at what would ordinarily be the meeting point of the loop. Otherwise a short circuit would result, and the wire loop would not heat up.—PETER J. M. CLUTE.

One Way to Make Egg-Collecting Easy

"COLLECTING eggs at the back-yard poultry-house is much easier than ordering them by telephone from the grocery," says one housewife, "if husband has equipped the poultry-house with exterior nests."

The idea is very simple and is easily applied. Several rectangular nest holes are cut in the rear house wall about three feet from the floor. In just the same position with these on the outside of the house is attached a long nesting compartment 18 in. wide, 18 in. high in the back, and 15 in. high in front. Partitions are not necessary. The compartment has a tight, sloping,

The "self-service" hen egg-house gives the housewife an excellent foresight as to egg prospects for the future

hinged cover to shed rain or water. The number of entrances should be one to about every two feet.

In obtaining eggs, the housewife simply steps to the back of the house and lifts the cover. At one glance she sees her visible egg supply and gathers an excellent idea of her "prospects." This nesting compartment should be made absolutely weather-proof; otherwise draughts will destroy its efficiency.—J. T. BARTLETT.

Cork and Glass of Water Trick

TO amuse a company, fill a glass nearly full of water, and drop into it a cork. The cork will naturally float on top. Then essay a bet that you can place the glass of water in such a position that no one can remove the cork without spilling every drop of water.

After everyone has given up the problem, take a piece of heavy paper or stiff cardboard and cover the glass with it by laying it over the top. Then invert the glass. No water will fall out, owing to the air-pressure. Now set the glass on a plate, still inverted, and gradually work out the piece of cardboard.

The cork will immediately float to the top of the water-level, thus being in a position where removal is impossible without spilling every drop of water.—CLARENCE T. HUBBARD.

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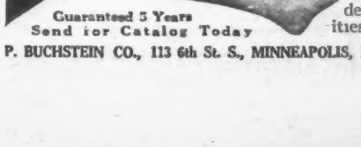

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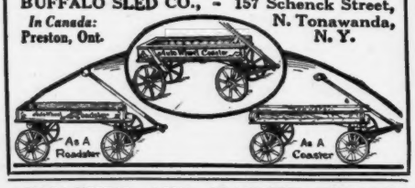

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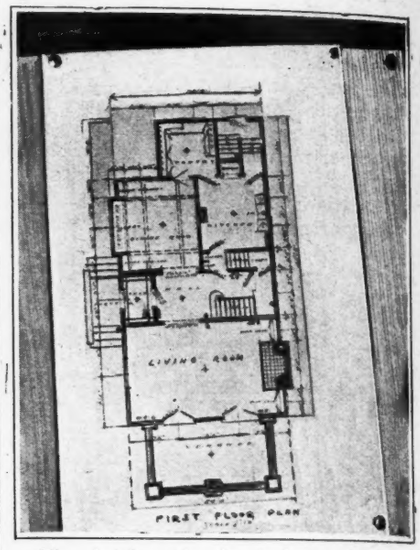
An Inexpensive Method of Photographing Drawings

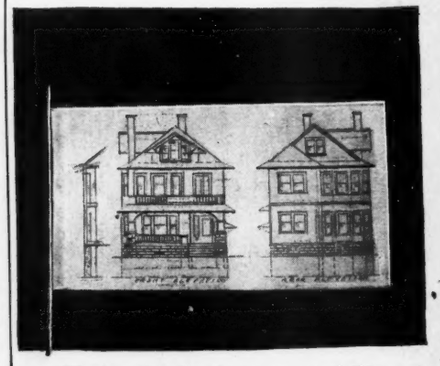
IT is often desired to keep a record of drawings that must be sent away temporarily. This can be done inexpensively with a small pocket camera, 3¼x4¼ in. While the photo-



The sketch or drawing is first tacked upon the board and then photographed

prints are small, they can be easily read with the aid of a magnifying-glass.

There are two ways of taking pictures of this kind, one being to set the drawing up with the light shining upon it and give it a ten-second exposure. The other and more preferable way is to secure the drawing to a window with stickers, block out all the other light so



Placing the drawing upon a window and then blotting out all other light is another way to photograph drawings

that all of the light will come through the drawing. Then focus the camera upon the drawing, give it an exposure of two seconds, and a satisfactory negative will result. The top print was obtained by the former method, the lower one by the latter.

Blue-prints may also be photographed in this manner if the second system is used and they are given an exposure of about fifteen seconds. Blue-prints, of course, will come up with the lines white on a black background.—GEORGE M. PETERSEN.

How to Build an Attractive Pergola

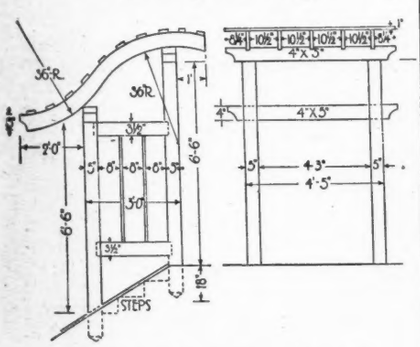
IN the grounds around country houses there is usually some hillside or slight incline where the landscape will be improved by building a small summer-house or pergola.

This type of building is very easy to make and only a few tools are needed.

It adds something to the artistic appearance of attractive grounds

Any boy can erect and paint such a structure with the following materials: 4 pieces 5-by-5 in. lumber, 2 pieces 4-by-5 in. lumber, 4 pieces 3½-by-4 in. lumber, 4 pieces 1-by-4 in. lumber, 5 pieces 1½-by-12 in. lumber, 10 pieces 1-by-4 in. lumber, 1 piece 2-by-2 in. lumber, 8 ft. lumber for posts, 4½ ft. lumber for caps, 2 ft. by 4 in. lumber for side-rails, 4 ft. by 4 in. lumber for side-slats, 6½ ft. lumber for pergola beams, 4½ ft. lumber for top slats, 4½ ft. lumber for front slat-mold on roof, 2 bunches cedar shingles for the roof.

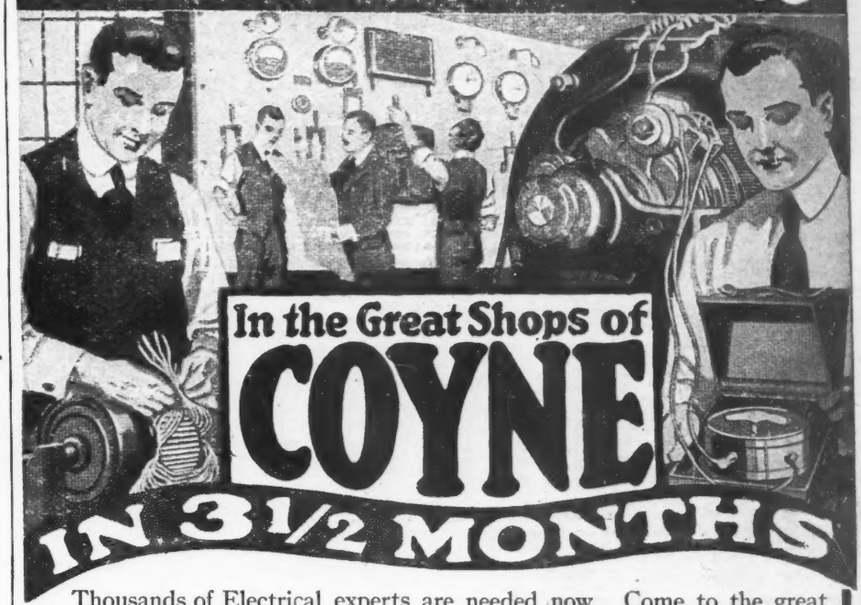
The drawings show clearly the nature of the different members and the exact method of putting them together by



Though simply constructed, the finished work has very pleasing lines

mortise, etc. The curved beams would be best made of one piece, and for this a plank of good width will be required. These can be cut out at a sawmill, but the amateur craftsman should find a deal of pleasure in cutting them for himself. A pattern (full size) is first made, and the rest of the pieces are cut from it. The sizes shown in the drawing denote the common size of timbers usually found in stock in a lumber-yard. Variations could be made in the structure without injury to the general design.—WILLIAM E. FRUDDEN.

Learn Electricity



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The Right Way to Take Up Slack in Tiller-Ropes

SMALL motor-boats that are steered by a wheel placed forward or amidships can make good use of the accompanying simple idea to take up

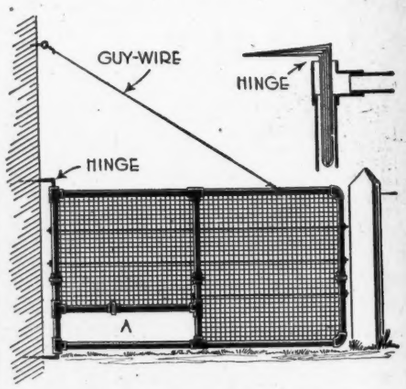
Damp weather nor old rope can not affect the boat's steering control if you take up the slack with spiral springs

automatically the slack in the tiller-ropes between the wheel and the rudder.

Remove a short section of the rope on each side of the wheel, and into these spaces insert two spiral springs similar to common door-springs. Arrange the springs so there will always be a slight tension on them when the steering-gear is not in use. Then, when the boat is under way and there is a strain upon the tiller-ropes, the springs will take up all the stretching that would eventually occur.—L. B. ROBBINS.

Why Does a Chicken Cross the Road?

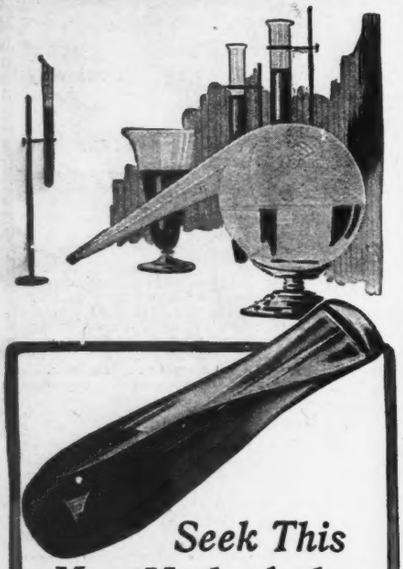
PICKING up old pieces of pipe in odd corners about the farm, an up-to-date farmer turned them over to the village blacksmith and told him to make the framework for an iron gate.



Because it is easier for her to walk through a specially made gateway than to fly over the barn-yard fence

The wire fretwork was woven by the farmer in his spare time.

The gate is unique in that it possesses a panel (*A*) left uncovered to permit the poultry free access to and from the barn-yard.—J. M. KANE.



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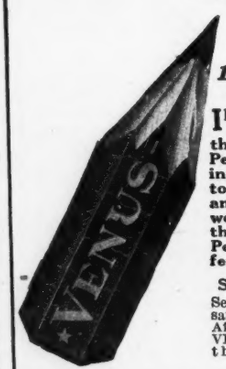

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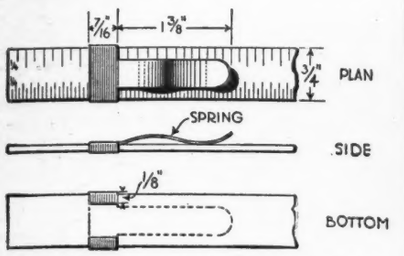
Keep Your Scale in Your Pocket with a Brass Clip

TO make a practical clip that will attach a carpenter's steel scale to his pocket, all that is needed is a piece of sheet brass cut wide enough to allow it to lap over the back of the scale about 1/8 in. After this is done cut away the surplus stock on both sides of the piece of brass, which will take the shape of the letter T.

Place the clip on a vise and clamp, the



No excuse now for losing your pocket rule if it has this easily made clip

clip and the scale tightly together, so that the edges of the clip may be turned over with a hammer to hold it on the scale.

Remove and file, finally polishing with an emery cloth, then bending the spring into shape.—H. KEPPLER.

Juggling a Wine-Glass on Top of a Card

THE performer takes up a playing card, displaying both sides, and also exhibits a small wine-glass. Placing the card on the edge of the glass, it tilts the card, and the glass appears to be balanced on the card.

To accomplish this feat, two cards

This trick, which appears almost impossible, is simply a matter of pasting two cards together

are pasted together. The back card, to be exact, is only half pasted, so that running lengthwise there is a "flap." When the flap is extended it will do the trick as shown in the illustration.—CLARENCE T. HUBBARD.

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A Hundred Tons of Hay in One Stack

TO stack one hundred tons of hay in one pile without moving the derrick is a simple matter if the derrick is one of the telescopic sort here illustrated.

There were approximately ninety-three tons of alfalfa hay in this stack, which was inspected on a farm in Richardson County, Neb. The stacking was done with an ordinary double-harpoon hay-fork on a cable carrier running on a steel cable supported by three two-legged towers.

The stack is begun next to the middle tower, and built in sections of 36 ft.

"Some stack," you say, but it's merely the simple method employed in piling the hay that accomplishes this feat

each in length. Each section is topped out before a new one is begun; then the carrier-stop on the cable is moved out 36 ft. farther toward the end tower, and the process repeated. An equipment of this kind provides for a variable crop, and reduces to a minimum the time spent in adjusting derricks, etc.

Stout poles are best for the construction of the towers. The poles best suited to this work are 25 ft. in length, set 3 ft. in the ground. The end towers are securely cross-braced. The cable is carried over the tops of the end towers and anchored firmly to the ground by means of heavy stakes driven deeply into the ground—or, better still, by fastening to a tree if possible.—A. A. JEFFREYS.

Don't Wait for Somebody to Get Hurt

ACCIDENTS are usually caused by little things, such as projecting boards with nails, pieces of upstanding glass, piles of rubbish about premises, unguarded machinery, stores that are piled carelessly and liable to fall, holes in platforms and floors, weak ladders, loose hammer-heads, sewers left open, absence of signals or other protection.

These are the things that most men walk over and around and see every day, but that they do not think to remedy until someone gets hurt or killed.

Get into the habit of watching for the little things, and the big things will take care of themselves.—FRED GILMAN.

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The supply at this price is very limited, the price will probably be raised when my next advertisement appears, so don't delay. Fill in the coupon today—mail to me—the typewriter will be shipped promptly. There is no red tape. I employ no solicitors—no collectors—no chattel mortgage. It is simply understood that I retain title to the machine until the full $53.15 is paid. You cannot lose. It is the greatest typewriter opportunity you will ever have. **Do not send me one cent. Get the coupon in the mails today—sure.**

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Ship me a No. 10 Smith Premier F. O. B. Chicago, as described in this advertisement. I will pay you the $44.00 balance of the special $53.15 purchase price, at the rate of $4.00 per month. The title to remain in you until fully paid for. It is understood that I have five days in which to examine and try the typewriter. If I choose not to keep it I will carefully repack it and return it to the express agent. It is understood that you give the standard guarantee for one year.

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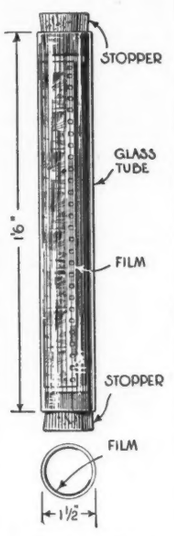
A New Way of Developing Photographic Film

ONE of the best methods of developing photographic film is the time and temperature method; but not all of us can afford the daylight developing tank. The following method has all the advantages of the tank method except one: it is not a daylight system. This means that the container must be charged in the darkroom. It has one advantage over the daylight system: it enables us to follow the development by observation.

The films are curled and inserted in a glass tube with the emulsion side in. The glass tube is provided with two stoppers. The lower one remains permanently in the tube, while the upper one is replaced after the developing solution has been poured into the tube. A cardboard tube used for mailing drawings is then slipped over the glass tube, and caps are fitted to the ends of the cardboard tube. The person doing the developing can then leave the room until the time of the development is complete.



It is quickly developed in the tube

Later the developing solution is emptied and the glass tube is filled with the fixing solution. After fixing is complete the film can be washed in the tube, and it need not be touched until it is ready for drying.

There is very little chance of the sensitive surface of the film being damaged; and when small films are enlarged this is an important consideration.—C. A. OLDROYD.

When You Can't Find a Single Envelope

THOUGH there is an envelope on the market similar to this one, the sketches herewith show how quickly one can be made from the ordinary size business letter-heads, using only a pocket-knife or scissors.

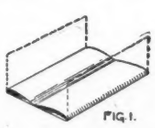


FIG. 1.

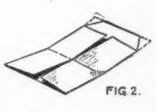


FIG. 2.

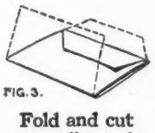


FIG. 3.

Fold and cut as directed

After folding as in Fig. 2, cut off on the dotted line, then fold the surplus ends as in Fig. 3, and cut them off on the fold, thus completing the envelope, with the exception of the library paste, which is applied to the flap when it is ready for sealing.—R. J. STEVENS.

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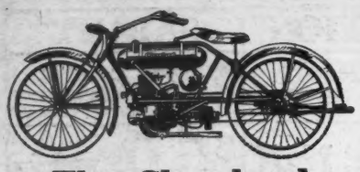

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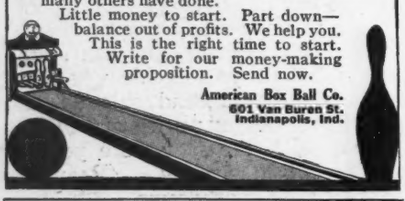

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The farm is an irrigated one, and running water is supplied from a near-by mountain stream by gravity pressure. This is piped into the barn and to the tank by means of a hose through the loft door, near which the hoisting mechanism is used chiefly for hoisting hay and sacks of grain into the loft.

The tackle is swung from the projecting eaves of the barn, and the lower end is provided with several attachments that may be instantly removed or applied. These consist of a hay-hook, a platform for lifting sacks

Water weight provides the motive power for this gravity hoist

of grain, and a connecting hook by which the power created by hydraulic weight may be conveyed to other points about the farm merely by attaching a cable.

If it is a ton of hay that the farmer has hauled from the field and wishes to store in his barn, he has only to drive the hay-hook to the tackle, and set the jaws in the load. He then goes to the loft, opens a valve, and starts the water flowing into the tank. Whenever the weight of the water in the tank becomes greater than the weight of the load to be hoisted, up goes the hay, grain, or whatever the load may consist of. The water is then turned off, the load is run into the loft, and the water that was used for producing the weight is run off into the nearest irrigating-ditch.

It is obvious that the lifting power of this type of hoist is limited only by the dimensions of the equipment used and that it may be made to do many things about the farm. "Genius" seems to be the Western farmer's middle name these days, for he is coming to the fore with crops and inventions that spell riches for him. —JOHN E. HOGG.

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Over each pattern, which should consist of about half a dozen teeth, write with indelible ink the correct gage.

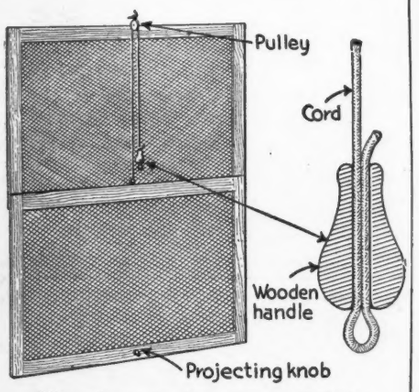
This is not generally known or practised and is a great time- and labor-saver. To use it, simply lay the desired sized pattern along the line marked on the edge with a sharp pencil.—L. B. ROBBINS.

A Counter-Weight to Hold Up the Window-Screen

WHEN a window is screened, the lowering or raising of the awning is always very awkward, making it necessary to keep a stick at hand with which to prop up the screen.

An excellent way to avoid this is to attach a cord to the lower screen at the center of the upper edge, run it up over a pulley at the top of the window-frame, and then attach a wooden handle to the lower end, allowing the cord to project from below in the form of a loop, as shown in the illustration. A stout wood-screw should then be set in the lower member of the screen frame so as to project about $\frac{3}{8}$ in.

To raise a screen so equipped, it is necessary to use only one hand, as it



The many who have jammed their fingers by forgetting that an unweighted screen won't stay up, will no doubt, adopt this contrivance

is a simple matter to pull on the handle until it comes opposite the projecting screw, over which the loop is then hooked. It is always easier to pull a given weight than to lift, and when one desires merely to lower the awning, it is not even necessary to hook the cord on the screw, as the screen is easily held up while the other hand releases the awning rope.

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The Michigan Auto School, in our opinion, is the finest institution of its kind in the country. So far as we are aware, its course of instruction is thorough, comprehensive and practical. In fact, we endorse its method of tuition.
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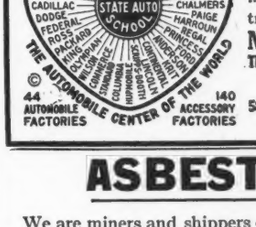
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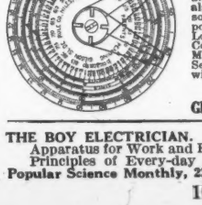

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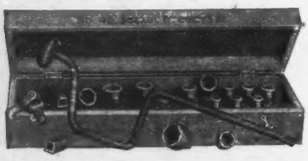

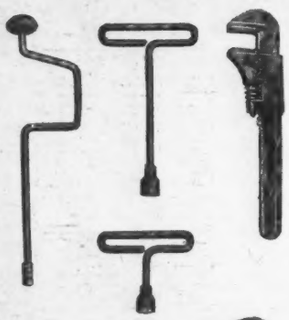

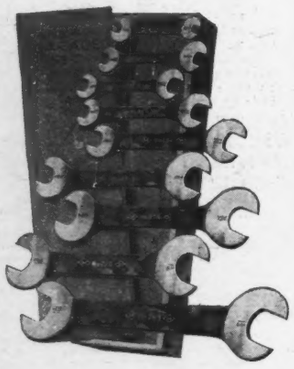

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SOLDERING is one of the easiest operations, and its applications for both temporary and permanent work about the house, farm, and workshop are almost endless. The main thing to remember is that the surface to be joined together by or patched with solder must be thoroughly clean. To attempt to solder a dirt surface is about as tedious and unsatisfactory an operation as can be imagined.

Then comes the question of a flux, and it is well to say in passing that the function of a flux is to keep the metal surfaces clean and exclude the oxygen of the atmosphere. For things that can be well washed after they have been soldered, zinc chloride is the best flux. This is made by dissolving zinc in hydrochloric acid until the acid will dissolve no more. Better keep a small piece of zinc in the solution, as it precipitates the copper with which the solution becomes contaminated because of the continual dipping of the point of the soldering copper in it.

For the soldering of electric wiring, however, which cannot be thoroughly washed, resin must be used as a flux; for, if zinc chloride is not thoroughly washed off copper and iron, it starts corrosion, which is continued by atmospheric influences, finally eating completely through the wire and causing no end of trouble.

Before You Start

Before starting to solder anything, see that the point of the soldering copper is well "tinned," that is, well covered with solder. This is accomplished by cleaning it thoroughly on coarse sandpaper or on a board with coarse sand on it, or, if it is badly corroded, by filing it with a coarse file. Having cleaned it, dip the point of the copper in the zinc chloride, heat it to a little above the melting-point of the solder, dip it momentarily in the flux again, and rub the point on the solder until the four sides are well covered with the material.

In soldering two things together, it is well first to "tin" the surface to be joined. It makes the operation easier and gives a better joint. This is done by first moistening the surfaces with the soldering flux, and then with the heated soldering copper, rubbing the molten solder over the surfaces until it adheres to them. Care should be taken not to have an excess of solder on the surfaces; that is, they should not be lumpy. The two pieces to be joined are again moistened with the flux, placed in the desired position, and heated with the soldering copper until the solder melts. The surplus solder is squeezed out by pressure, and the pieces are held in position by pincers or by some other means until the solder sets. A little solder can be run round the edges of the joint to make a neat job.—F. H. SWEET.

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Electricians, telephone men and switchboard builders will find this particular oblique cutting plier one of the most useful tools in their kits. Cuts clean and close, the narrow head permitting its use in confined places. Carried by dealers everywhere.

Catalog sent you on request.

MATHIAS KLEIN & SONS, Mfrs.

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OTTAWA KEROSENE ENGINES

Start Easy in any weather. Pull steady. Carry big overload. All sizes and styles. 1½ H-P. to 22 H-P. **90 Days' Trial. Money Back Guarantee.** Prompt shipment.

Low Prices Write for present money saving prices and **Free Book,** telling all you want to know about engines. Write today.

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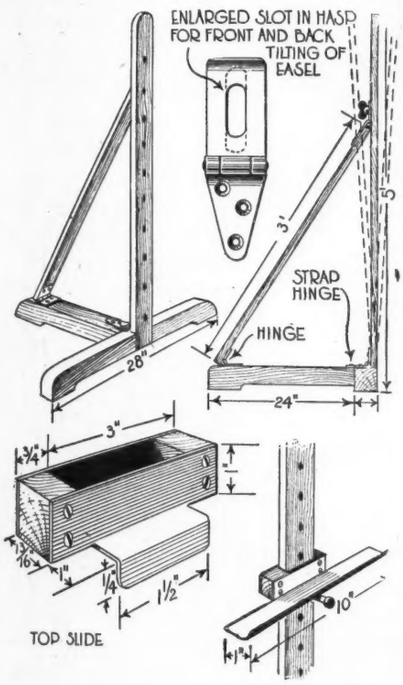
IDEAL MACHINE & TOOL CO.

128-130 Opera Place CINCINNATI, O. Dept. 1-B

A Good Home-Made Folding Easel

PROCURE two pieces of 3-in. lumber, preferably pine, and cut them into pieces 28 in. and 27 in. in length. These pieces are to form the base of the easel, and may, if desired, be rounded at the corners or left square, as preferred. The long piece of pine is halved in the center, while the short piece is halved at the end, which will then fit into the long piece. These ends may be mortised if desired, as this method makes a more substantial base for the easel.

After securely bolting these two pieces together, the base is complete and ready for the upright. The upright is made of the same material about 5 ft. in length of 1 x 3-in. pine.



An artist can make it from easily purchased materials

Drill holes 6 in. apart from the top in the center of the upright to within 8 in. of the bottom to take a ½-in. pin. Set this upright on the base, and screw fast with a 7- or 8-in. strap-hinge, as shown. Now fix a brace in the rear end of the base, which is also fastened with a hinge. An enlarged slot allows for the forward and backward movement of the easel. Screw a rasp into place, and drill a hole into the upright to accommodate a small stove bolt with a wing-nut and washer, the wing-nut being set in the back through the opening in the hasp.

The slides are made of small strips of brass bent into the shape shown in the sketch and screwed into small blocks of the same thickness as the uprights. The lower slide is held in place by the pin inserted into the ½-in. hole. The top slide does not need anything but its own weight to hold the canvas, and can be raised or lowered.

Different Metals Require Different Hack Saw Blades

If you want to cut structural steel or brass pipe efficiently, you need a different hack saw than for cast iron or machine steel, and you certainly can't work as coarse a blade in a light machine as in a heavy one. To try to do everything with the same blade is simply to do most of it inefficiently.

Starrett Hack Saws

do the most work with the least effort in the shortest time because each one is made to meet the exact requirements of different metals in different powered machines.

Our Hack Saw Chart will help you select the proper blade for any kind of work, and you can depend upon it. Our Service Department will help you solve your cutting problems and increase the efficiency of your cutting-off department.

Write us today. Ask for Catalog No. 21W

THE L. S. STARRETT COMPANY

The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled

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2226 Empire Bldg., Pittsburgh, Pa.

Genuine Armstrong Stocks and Dies

Have You a Set in Your Kit?

Some of the advantages of Genuine ARMSTRONG Stocks and Dies:
They can be adjusted to the variations in the size of fittings.
Results are accomplished with less work and time.
The Dies are interchangeable in the stocks and they can be sharpened without drawing the temper.
Our catalog tells the rest of this interesting story; send for it *to-day*.

THE ARMSTRONG MFG. CO.
337 Knowlton Street - Bridgeport, Conn.

Make Big Profits in Battery Charging

$150 to $250 Clear Profit Each Month

recharging auto storage batteries. The HB 16-Battery Charger recharges 1 to 16 6-volt batteries or their equivalent at once with current cost of 12c to 15c per battery. Motorist pays 75c to $1.50. Figure your profits! This season means bigger battery business than ever—more old cars driven—new Fords to have storage batteries. Get busy now! Don't delay! Start after those profits!

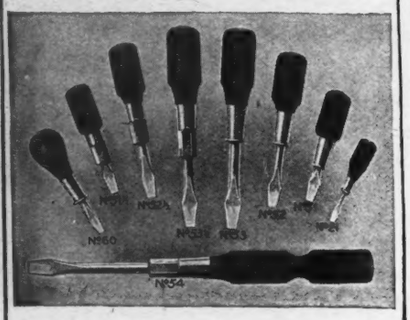
$57 Puts This Money-Maker in Your Garage on Money-Back Guarantee

Balance in 10 monthly payments of $23 each. Earnings pay for machine. No electrical knowledge necessary to operate. Uses 2 or 3 phase city current. Furnished complete with 2 charging panels capable of charging 1 to 8 batteries each. No adjustments or expensive renewals. Big, permanent profits. Sold on HB Absolute Money-Back Guarantee. Order Now—you run no risk. Pin your check to this ad and mail today for trial order. Do it NOW!

Hobart Brothers Company, Box S5, Troy, Ohio

Successful Manufacturers Since 1893

Stanley Tools



"HURWOOD"
Screw Drivers

Unsurpassed for Strength and Durability

Blade, Shank and Head—one piece of special steel, finely tempered. The blade cannot turn in the handle.

The assortment illustrated above is well worth your attention.

For instance—No. 21 shown at the extreme right of the picture—blade only 1½ inches long, just fits the vest pocket, a strong little Driver and very handy.

Also No. 60—shown at the left—only 1⅝ inch blade, but with a big sure grip handle. For heavy work into close corners it cannot be beaten. Used by Plumbers, Machinists, Millwrights, etc.

Nos. 51, 52 and 53—called MACHINISTS' DRIVERS—big, broad tips for large screws and extra large shanks for heavy work.

Nos. 51½, 52½ and 53½—also Machinists' Drivers, have hexagon nut on shank for use with a wrench.

No. 54—Note the DOUBLE GRIP, also the hexagon feature for wrench. With the latter Driver one can turn anything.

We make many other drivers. See Catalog No. 34S.

At All Hardware Dealers

STANLEY RULE & LEVEL CO.
NEW BRITAIN, CONN. U.S.A.

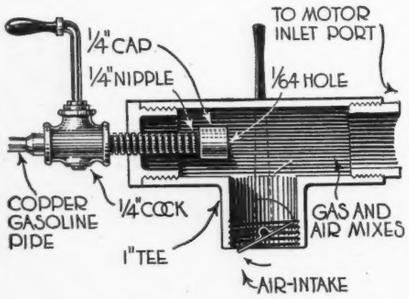
A Mixing-Valve to Take the Place of a Carburetor

ONE encounters many troubles in the ordinary float-feed carburetor, especially on low-speed engines such as marine or industrial types. In experimenting with various engines it was found to be more expedient to use a mixing-valve than the average carburetor.

While there are numerous contrivances of this sort sold, the valve can be easily and cheaply made by almost anyone.

Of course, everybody knows that gasoline and air must be mixed to proper proportions to make a combustible gas. To accomplish this, it is necessary to have a gas inlet and an air inlet, both of which must be adjustable.

In starting the engine with the mixing-valve installed, it is highly important that the gasoline valve be opened, while the air inlet is closed. As the engine starts firing, the air inlet is gradually opened until the engine takes its charge without backfiring or choking, at which time it is



Doing the work of the high-priced carburetor, a home-make mixing-valve will save money for the small launch owner

utilizing the gasoline at its highest point of efficiency. When the engine is stopped the gasoline valve must be closed, to prevent the gasoline from dripping through.

To make this device, ascertain the diameter of the inlet port, procure a standard pipe Tee of equal diameter, and drill through its bottom outlet a ⅛-in. hole, penetrating both walls of the Tee. Insert therein a butterfly valve made from a piece of No. 16 gage sheet-iron cut to fit the inside of the pipe and soldered to the axis, which is made of a nail ⅛ in. in diameter. To this solder a brass spring held in its required position by notches filed in the side of the Tee, the edges of the arm being bent inward so that it engages the notch to assure the desired position. This arm or air-regulating lever is made from 1-16-in. spring brass soldered to the nail axle. The inlet of the Tee is fitted with a bushing which has a reducer thread of ¼ in., into which is fitted that size nipple. This nipple is threaded its entire length. After the nipple is screwed into the bushing, a cap is affixed to its end, through the center of which is drilled a 1-64-in. hole. On

The limit has never been found to the number of things you can do with

Red Devil
PLIERS

They are truly your "*Etc.*" tools.

Repair: Locks, Clocks, Toys, Jewelry, Guns, *Etc.*
Hang: Pictures, Bells, *Etc.*
Pull: Nails, Tacks, Needles, *Etc.*
Turn: Valves, Keys, Nuts, *Etc.*
Make: Lamp Shades, Hat Frames, *Etc.*
Cut: Wire, Cord
Etc.

Every day you find new uses, find yourself doing things around the house with "Red Devils" that you thought you couldn't do yourself.

Ask your hardware dealer to sell you the particular kind of "Red Devils" which will serve you best—and put them to work today.

SMITH & HEMENWAY CO., INC.
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"Red Devil" is the Expert Mechanic's guide to Known Quality in Pliers, Electricians' Tools, Hack Saw Frames and Blades, Auger Bits, Chain Drills, and other Hand Tools, all of a class with "Red Devil" Glass Cutters, the biggest sellers in the world.

De Forest's New Catalog

Illustrating and describing the very latest and best in **Radio Apparatus** for Discriminating Users is ready for mailing

Complete information regarding the De Forest "Unit" Set, "Honey Comb" Coils (a radical departure from previous forms of apparatus), variable air and fixed condensers, wavemeters, variometers, detectors, etc. Will be sent upon receipt of 10c. to defray postage.

De Forest Radio Tel. & Tel. Co.
1391 Sedgwick Ave. New York City

the outside of the reducer nipple is fitted a ¼-in. valve, to which is connected the gasoline supply.

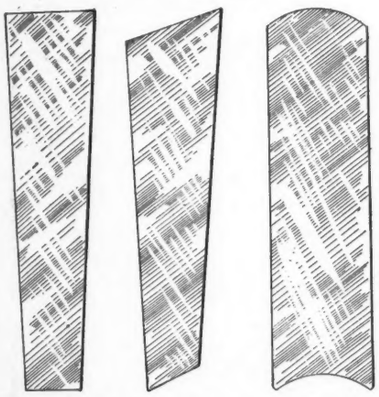
A butterfly throttle valve may be fitted into the intake nipple, but a very good throttle is obtained by the use of the air-valve. This is done at the expense, more or less, of the gasoline consumption; but by the use of the butterfly throttle the entire pipe vacuum or suction may be so regulated that its efficiency is 100 per cent.

This mixing-valve is especially adapted to engines of 500 to 1000 revolutions per minute, and it will be found to be extremely easy starting on engines of this kind.—P. P. AVERY.

Home-Made Scraper Blades for Carpenters

IT will pay any carpenter who has to do finishing to go to the trouble of making himself three or four narrow scraper blades similar to those here illustrated.

Three or four such scrapers can be made from one standard 6-in. scraper



This type of scrapers offers an excellent hand-hold and will reach all corners in panel work

steel, and will be found useful in numberless instances where the ordinary wide steel is too wide or too large, or else improperly shaped to do the work. Often shallow depressions in panel work or corners can either not be reached at all with an ordinary scraper, or can be worked only with great difficulty. Rounded stock also is ill fitted to be worked with a square blade, and then again shallow rounded depressions need to be worked out where a gouge will not do because it cannot be easily controlled.

With the set of narrow blades shown, all these different jobs can be satisfactorily performed. Two advantages of these scrapers are that they offer an unusually good hand-hold. Owing to this and to the shortness of the cutting edge, four or five times more pressure can be exerted than with an ordinary wide blade. In difficult and awkward places this will be found to be of the utmost importance.

By the use of the rounded scraper the rim of a sink or other enamel or iron body can be perfectly scribed into a very good drain-board or table-top.—HENRY SIMON.

DISSTON

The Saws Used Exclusively by Many of the World's Largest Saw Mills

Each year finds a greater number of the leading saw mills of the world using DISSTON SAWS exclusively.

The high quality of DISSTON Band, Circular, and Gang Saws is proven by the excellent results obtained in the actual work.

Made of DISSTON CRUCIBLE Steel, the product of the DISSTON Steel Works, of a toughness, strength and elasticity unsurpassed, low cost of lumber production and small repair bills are natural results.

DISSTON SAWS have been the leaders for nearly eighty years. When values are compared and saw-mill operators find their preference backed up by the experience of others, the immense growth of this industry, which is now the largest saw manufacturing business in the world, is readily explained.

When you need a saw, no matter what purpose it is for, buy a DISSTON, which is backed up by the long, favorable DISSTON record for QUALITY, VALUE and SERVICE.

Henry Disston & Sons, Inc., Philadelphia, U.S.A.

"America's Longest Established Makers of Hand Saws, Cross Cut Saws, Band Saws, Circular Saws and Tools"

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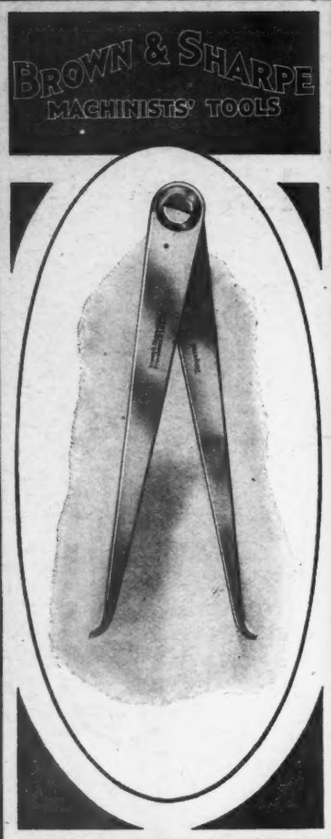
DISSTON SAWS AND TOOLS Standard for Nearly Eighty Years—and Growing Faster Every Year



Service

Through the use of these tools you obtain the service that seventy years of experience in tool making offers.

The nicety of finish is the visible evidence of quality.

That which you can not see—but can always feel is there—is the highgrade accurate workmanship that has been put into every tool—guaranteeing reliable results and satisfactory service.

Get acquainted with these well-known tools and enjoy the dependable service they offer you.

Brown & Sharpe Mfg. Co.

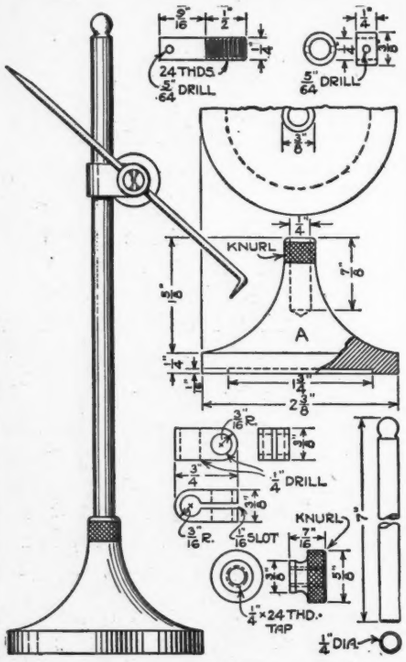
PROVIDENCE, R. I., U. S. A.

The Useful Surface Gage—How to Make It

THE surface gage is a very useful tool around a planer or shaper, and it will be found of value in laying out work on surface plates, etc.

The vase can be made of cast-iron and turned up in the lathe, recessing the bottom as shown in the illustration to give a good bearing.

The upright rod is made of a piece of ¼-in. die cold rolled steel, the hole it enters in the base reamed to 1/1000 of



The completed surface-gage is a very useful instrument on planers, etc.

an inch smaller, thus making a light press fit.

The scriber should be made of 5/64-in. die drill-rod, bent at right angles on one end and the points hardened. All the other parts may be made of soft steel, and, after polishing, heated and left immersed in a pot of melted cyanide for about fifteen minutes' quenching in cold water.

Tools should never be put away without first wiping them thoroughly all over with an oily rag, to prevent rust. Never pile tools on top of one another. Such carelessness causes dented and scratched surfaces, rendering the tools inaccurate.

The old saying that a good mechanic is known by his tools is as true as ever.—A. DANE.

How to Test an Article for Gilt

ALL that is required to recognize whether an article is gilt or not is to touch it with a glass rod that has been dipped in a solution of bichloride of copper. If the article has been gilded the spot touched will remain intact, while it will present a brown stain if no gold is deposited on its surface.—HERMAN NEUHAUS.

Provide for Low Labor-Cost

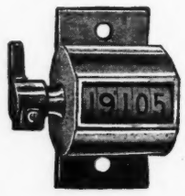
The high cost of labor for operating machines necessitates a high rate-of-output from your machines—and you *equip* them for this when you put on Veeder Counters.

Veeders are the means of maintaining the best rate-of-work a machine is good for, and *their presence* on a machine insures labor-efficiency which beats down the cost of production.

Veeder
COUNTERS

aid in *developing* machines no less than in operating them, by registering the results of *mechanical improvements* as they prove up in the *production-rate.*

The small Revolution Counter below registers one for a revolution of a shaft, recording a machine operation. Though small, this counter is very durable; its mechanism will stand a high rate of speed, making it especially suitable for many types of small machines. A most adaptable counter for experimental work. (Will subtract if run backward.) Price, $1.75.



For recording and checking-up the output of larger machines, such as punch presses, metal-stamping machines and the like, where a reciprocating movement counts an operation, use the Set-Back Rotary Ratchet Counter below.

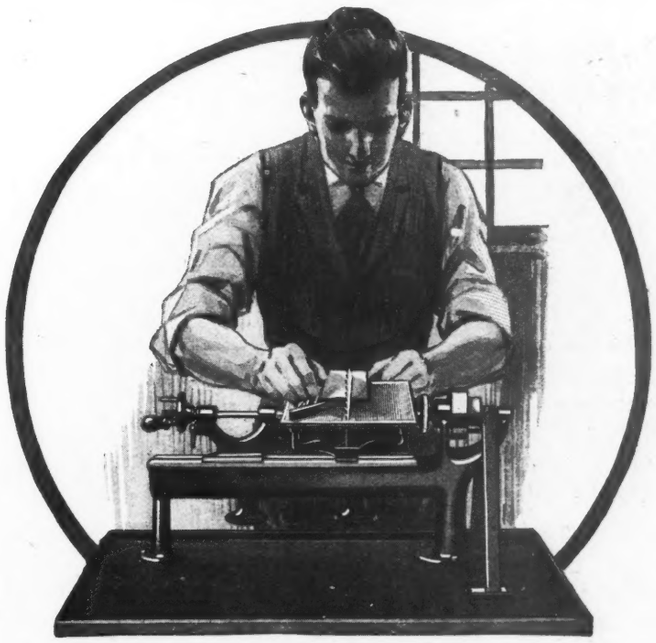
Registers one for each throw of the lever, and sets back to zero by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price, with four figure-wheels (as illustrated) $10 (list).

Free booklet shows counters for more purposes than we can advertise—you'll see just the sizes and styles for ***your uses.*** *Shall we send you a copy?*

The Veeder Mfg. Co.
44 Sargeant St., Hartford, Conn.

GOODELL-PRATT
1500 GOOD TOOLS

Amateur Bench Lathe No. 125
For a Variety of Work



Makers of Mr. Punch

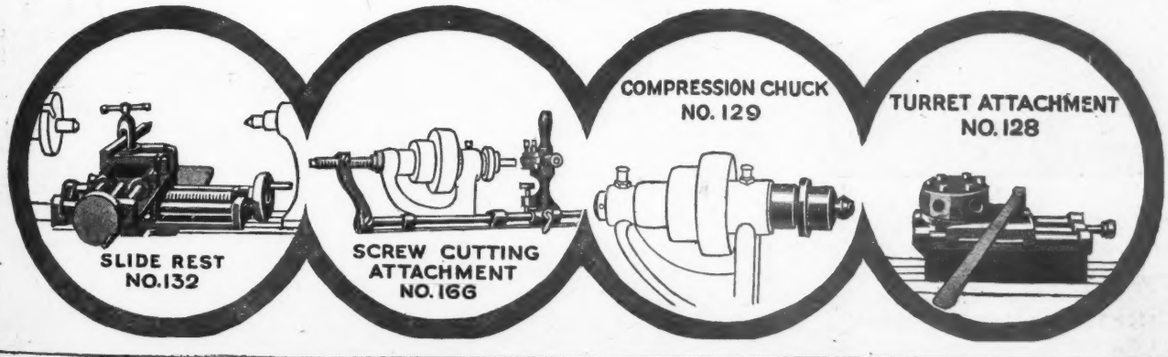
Makers of Mr. Punch

WORK out your ideas on this practical little lathe. It will handle a wide range of work. In fact, with the attachments shown below it gives you almost a complete shop in your own home or laboratory.

It will take work up to 12 inches in length, with a swing of 7 inches. It is furnished with an adjustable Tee Rest, a Slotted Face Plate, a Saw Arbor and a Drill Chuck of 0 to ¼-inch capacity, with a No. 1 Morse Taper Shank. The Tail Stock has both lever and screw feeds.

This useful machine has all of the good features which characterize the Goodell-Pratt line of 1500 different tools. The same skilful workmanship, the same careful selection of materials, the same simplicity, utility and sturdiness are just as evident in this lathe as they are in any other Goodell-Pratt Tool. Let your dealer demonstrate what a serviceable machine this lathe is. And don't delay writing for a more complete description.

GOODELL-PRATT COMPANY *Toolsmiths* Greenfield, Massachusetts, U. S. A.



GOODELL-PRATT COMPANY *Toolsmiths* Greenfield, Mass., U. S. A.

You Can Take Hills on High Without A Knock

If you will keep your motor free from carbon. That knocking in your engine—the difficulty you have climbing hills—poor pick-up—lack of power—noisy motor—pre-ignition—in fact 80 per cent of engine trouble is caused by carbon. Clean it out with

JOHNSON'S CARBON REMOVER

and your engine will run like it did the first 500 miles—quietly and full of "pep". And your gasoline consumption will drop 12 per cent to 25 per cent.

Do It Yourself

For 35c—five minutes' time—and no labor you, yourself, can remove all carbon deposits. Pour or spray an ounce of Johnson's Carbon Remover into each cylinder through the petcocks or spark plug openings. Let the car stand for half to three-quarters of an hour; then take your car out on the road, drive it 10 or 15 miles at a fairly good rate of speed. You will be surprised at the wonderful improvement.

Use It Every 500 Miles

If you will use Johnson's Carbon Remover at regular intervals giving carbon no chance to accumulate, you will automatically eliminate most valve trouble and your engine will always be at its highest efficiency.

S. C. JOHNSON & SON, Racine, Wis.
Established 1882

Johnson's Carbon Remover is recommended by many car manufacturers including the Packard and Studebaker Companies. Handled by all representative dealers and jobbers. Insist upon yours supplying you. Write for further information and copy of our booklet on Keeping Cars Young—its free.

S. C. JOHNSON & SON, Dept. P.S.M. 5, Racine, Wis.

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